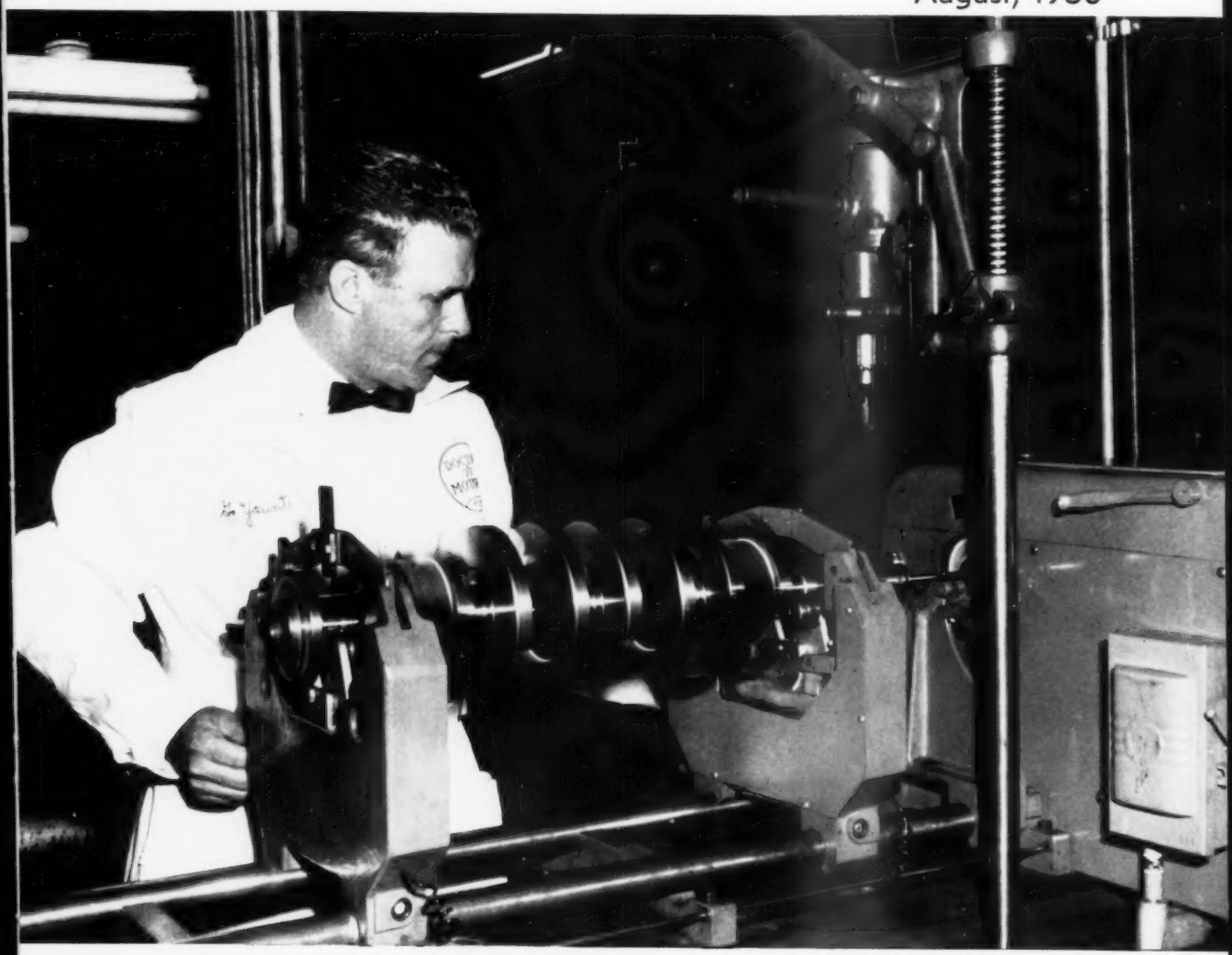
Automotive Service Digest

Our 46th year

August, 1958



Where performance hangs in the balance—See Page 14

Since 1903...

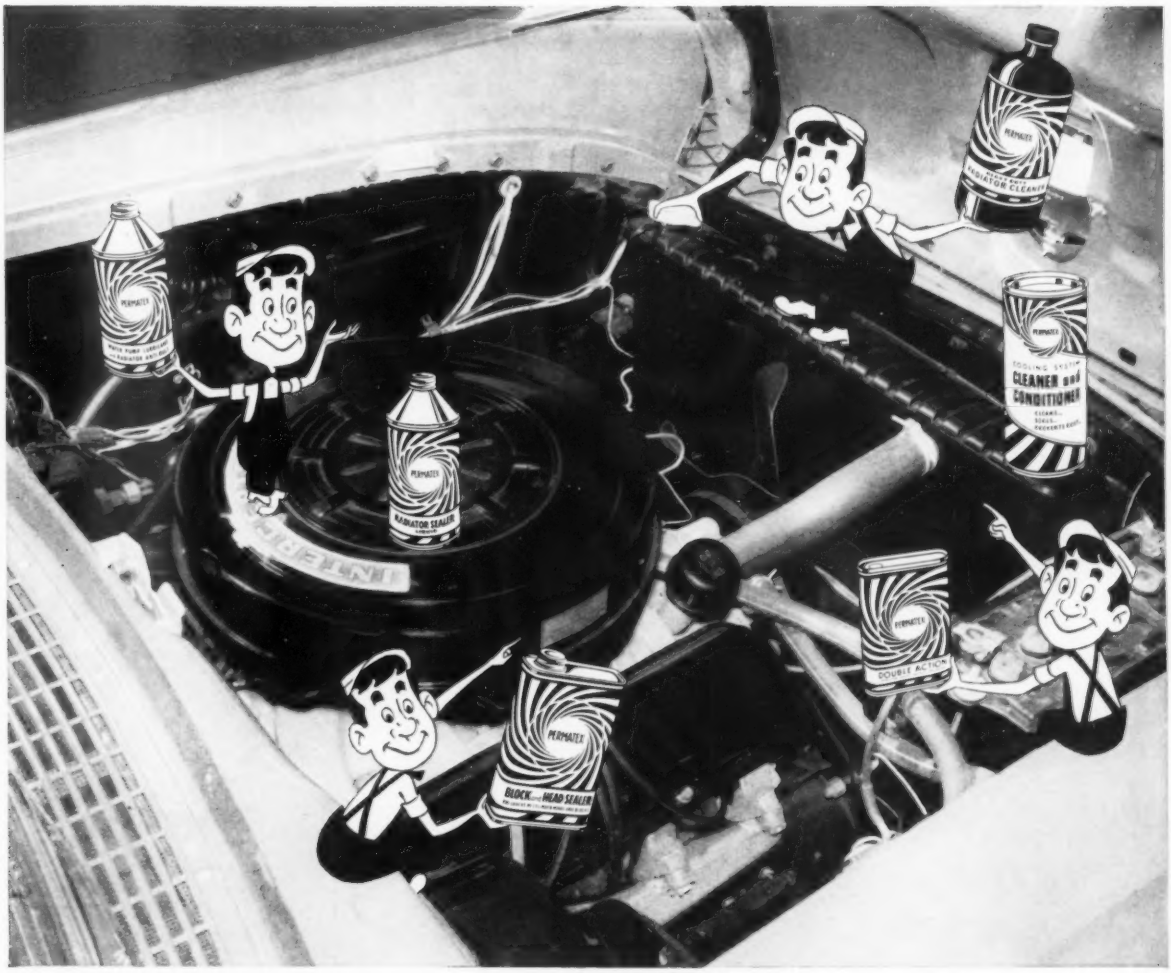
PARTNER
IN PROGRESS
to the
AUTOMOTIVE
INDUSTRY

AMBASSADOR—One of the many outstanding motor cars using Perfect Circle piston rings for both original equipment and replacement service.

Behind the world-wide acceptance of Perfect Circle is a history of more than half a century of PC engineering leadership—and more. There's a history, too, of unceasing creative research... a constant search for the new and the better... matchless manufacturing skills...and scores of contributions to the forward march of the automotive industry, year after year.

Leading manufacturers specify piston rings developed in co-operation with Perfect Circle engineers. You and your customers benefit with Perfect Circle's achievements in engineering, research and manufacturing skills when you install PC rings. Perfect Circle Corporation, Hagerstown, Ind.; The Perfect Circle Co., Ltd., 888 Don Mills Road, Don Mills, Ontario.

PERFECT CIRCLE PISTON RINGS



WHATEVER A COOLING SYSTEM NEEDS... A PERMATEX PRODUCT FITS IT BEST

Radiator to water pump to water jacket . . . cooling systems can be headaches . . . and Permatex provides the aspirin. From major leak sealers like Block and Head Sealer to rust preventives like Water Pump Lubricant and Radiator Anti-Rust . . . Permatex has tailored the *exactly* right product to make the job easy and profitable. *Be prepared* with these Permatex products: DOUBLE ACTION RADIATOR CEMENT . . . HEAVY DUTY RADIATOR CLEANER . . . WATER PUMP LUBRICANT & RADIATOR ANTI-RUST . . . BLOCK AND HEAD SEALER . . . RADIATOR SEALER (liquid) . . . COOLING SYSTEM CLEANER AND CONDITIONER.

Send for your copy of the Permatex Catalog . . . which tells you how and where to use every member of this famous automotive chemical family. Ask your jobber or write us.

PERMATEX

PERMATEX

COMPANY, INCORPORATED
300 Broadway, Huntington Station, L. I., New York
Factories: Brooklyn, N. Y. • Kansas City, Kansas

"There's a Permatex product for every maintenance need"

SEALING COMPOUNDS • POLISHES AND CLEANERS • RADIATOR PRODUCTS • OILS AND LUBRICANTS • HYDRAULIC FLUIDS • SERVICE AND REPAIR PRODUCTS

Interested in servicing

Champion has the right spark plug

Two-passenger **BMW ISETTA** develops 13 hp from one-cylinder engine, uses Champion L-5 or L-11S. **JAGUAR** XK140 6-cylinder engine uses Champion N-8 or N-8B in 8:1 compression ratio models.

More than 5% of all new cars being sold in this country are imports. It's a growing market that you may want to go after. If you do, you don't have to wonder about what make of spark plugs to carry. Champion has the plugs you need.

Makes no difference *where* the car was born. Germany . . . England . . . France . . . Sweden . . . Italy . . . anywhere. Champion has a spark plug that speaks its language like a native. In fact, most of these cars start life with Champions in their engines. (Champions are factory installed in 36 makes of cars – more than twice as many as any other plug.)

Since most foreign cars take different plug types than American-made cars, you can't service them out of your regular inventory. And, frankly, we don't advise you to stock up on these special types unless you have a sizable foreign-car traffic. You can get the plugs from your regular Champion supplier when you need them.

But remember – you can service all makes of foreign cars with CHAMPIONS – just as you can service every car made by Ford Motor Co., General Motors, Chrysler Corp., American Motors, and Studebaker-Packard, with 5-rib Champion Spark Plugs!

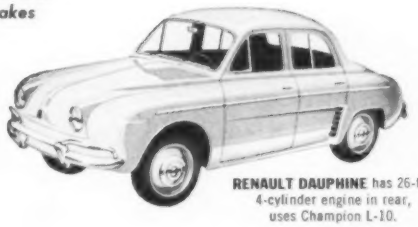
CHAMPION SPARK PLUG

foreign cars?

for every foreign car sold in America!

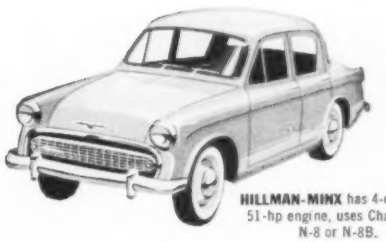
Illustrated below are several of the well-known makes

VOLKSWAGEN has 4-cylinder, 36-hp air-cooled engine in rear, uses Champion L-85.



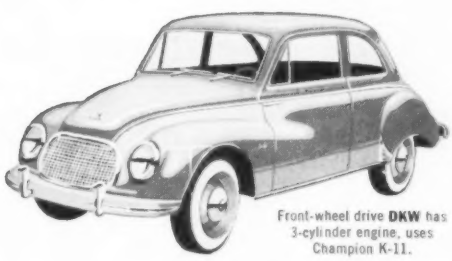
RENAULT DAUPHINE has 26-hp, 4-cylinder engine in rear, uses Champion L-10.

ANGLIA (English Ford) has 4-cylinder, 36-hp engine, uses Champion L-10.



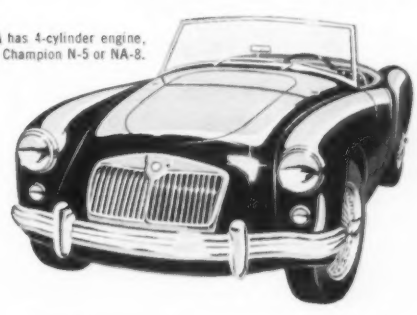
HILLMAN-MINX has 4-cylinder, 51-hp engine, uses Champion N-8 or N-8B.

ROLLS ROYCE Silver Cloud uses Champion N-8 or N-8B.



Front-wheel drive **DKW** has 3-cylinder engine, uses Champion K-11.

MGA has 4-cylinder engine, uses Champion N-5 or NA-8.



VOLVO has 4-cylinder, 60-hp engine, uses Champion J-6.

FIAT 1200 convertible with 4-cylinder, 155-hp engine, uses Champion H-9 or H-8.

FLASH!

Last month at Monza, Italy, in the fastest race ever run, the winning car was powered by Champion Spark Plugs!

WORLD'S FAVORITE—

CHAMPION

SPARK PLUGS

COMPANY • TOLEDO 1, OHIO

Why you should use ren epoxy

Toolmakers Epoxy Plastic Now
Formulated for Auto Body Repair Shops

REN PLASTIC SOLDERS

A BETTER "BUMP" JOB EVERY TIME— TWO TYPES FOR COMPLETE SERVICE

Both Ren Deluxe and Ren Superfast Solders — the epoxy plastics — offer savings in time, material and labor . . . offer you peak performance while working the material and your customer gets complete satisfaction with the finished job. Just check these advantages compared to other filler materials. So Easy to Apply that in three simple steps you're ready to paint; Safer because it does not contain highly inflammable materials; Dimensionally Stable . . . Ren will not shrink, crack, rust, rot, mildew, dry out, "pop-off," corrode nor check or bleed through paint; the Initial Cost is Lower because a 3 lb. can has the filling capacity of 19 to 20 lbs. of lead solder; Bonds Permanently and the one-to-one resin to hardener mixture Eliminates Waste. Now ask yourself if you can afford to be without Ren Plastic Solders another day. Because auto body repair shops have two types of work problems . . . "rush" jobs and "slow" jobs Ren developed two epoxy solders to help control work load variation. Ren Superfast is the first and only fast epoxy body repair material on the market . . . it sets up in 4 minutes while the Deluxe sets up in 2 hours. Both work along with you.

REPAIRS
- Dents • Holes • Tears
- Leaks in

gas lines, oil lines, radiator water pipes, motor blocks, heads, gas tanks, vent pipes, transmission housings

FILL AND REPAIR
- Rocker Panels
- Doors
- Fenders
- Roofs
- Trunks

FOR FRENCHING, HOODING, DE-CHROMING, CUSTOMIZING

ren PLASTICS, INC. LANSING 9, MICH. • SPECIALISTS IN EPOXY COMPOUNDING

Oscar H. Baehler, Publisher
Ned H. McCormack, Manager
Ben M. Ikert, Editor
G. A. Whittington, Managing Editor
Herb Carrier, Detroit Editor
Guy F. Wetzel, Technical Editor
Ed Packer, Feature Editor
E. S. Harris, Field Editor
Gerry Dawson, Assistant Editor
Leslie L. Flood, Art Director

MEMBER ABC ABP

Published and printed monthly at Chicago, Ill., by Automotive Service Digest, a division of National Market Reports, Inc., 900 So. Wabash Ave., Chicago 5, Ill.

W. E. Butler, chairman of the board
H. G. Hollingshead, president
Chas. E. Gambill, vice pres. & treasr.
O. H. Baehler, vice pres. & genl. mgr.
J. R. Sullivan, secretary

Subscriptions: $4.00 for 1 year, $6.00 for 2 years, U.S. Possessions and Canada. Single copies 40c. Back copies 75c ea. Foreign subscriptions $5.00 per year. Second class mail privileges authorized at Chicago, Ill. Copyright 1958 by National Market Reports, Inc.

Charles W. Taylor, circulation manager

BRANCH ADVERTISING OFFICES

New York 17, N. Y.
John F. McCormick
103 Park Avenue
ORegon 9-7687

Chicago 5, Ill.
O. T. Butcher
900 S. Wabash Ave.
HArrison 7-3464

Detroit 2, Mich.
Frank Heib
914 Stephenson Bldg.
Cass and Grand Blvd.
TRinity 3-4840

OTHER ADVERTISING REPRESENTATIVES

Los Angeles 57, California
The Maurice A. Kimball Co., Inc.
2550 Beverly Blvd.—DUnkirk 8-6178

San Francisco, California
The Maurice A. Kimball Co., Inc.
681 Market St.—EXbrook 2-3365

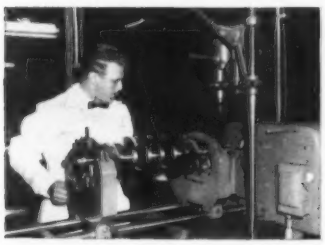
Kansas City, Missouri
C. H. Stockwell Co.
4117 West 67th St.—COlfax 2-5131

Minnesota-Wisconsin
Badger & Flanagan
35 E. Wacker Drive, Chicago, Ill.
ANdover 3-5399

VOLUME XXXXVI
No. 559

Automotive Service Digest

August 1958



Cover

One of 22 crankshafts which George Yount of Eagle Machine Co., Indianapolis, balanced for this year's 500-mile race. Crank shown is an Offenhauser.

Articles

14 Single and two-plane balancing
24 One-stop service
28 Accenting the trade in training
34 When is a tune-up a "tune-up"?
38 So you want to open a service shop?
44 Servicing air conditioners—Part III
52 Fuel control systems
66 Announce 4-cylinder automotive diesel
68 New electrical team from Delco

SYMBOLIZES A.S.D. "TECH KNOW-HOW" FEATURE ARTICLES

Features

6 Automotive clinic
8 Spokes from "the hub"
10 Instrument corner
13 The Editor's page
50 Photos from here and there
58 New products
75 Refresher course
73 Calendar of automotive events

For September

● For many readers September's the month to fold up the vacation maps, put away the fishing tackle and get back to the old grind—valve grinding that is. Copious reading of ASD should be resumed, too. Along that line we've got articles with teeth in them.

● We're following through on Fuel Control Systems, which makes it's bow in this issue. . . . Another one on shop lighting. When you're splitting thousandths of an inch you have to see what you're doing. This article, by the way, is a standout.

● Coming, too, is the first of a series on front suspension; types, how they work, and how to service them. More on air conditioning service in September also.

● All the room we got to tell you about the coming issue. . . . You'll like it.

Automotive clinic

Stuck on some problem? Need help on a job? Write us about your problem on your shop letterhead and the information you are looking for will be promptly sent you.

Address your letter to Automotive Clinic c/o AUTOMOTIVE SERVICE DIGEST, 900 S. Wabash Ave., Chicago 5, Ill.

Ben Ikert, Editor

Detonation Can Cause Engine Damage

I don't run a shop, but since my prime interest and hobby in cars takes up the majority of my off time I would greatly appreciate your diagnosing my case of "Hole in Piston".

Here are the circumstances: I was running a 1956 Chevrolet V-8 with power pack, 9.5 to 1 compression ratio, with stock heads. The cam was a 1956 Corvette with solid lifters and an Edelbrock manifold with three 2-barrel carburetors. I was running the engine at about 4,500 r.p.m. in high, and had held it down under these conditions for about two miles. The engine would normally run at 4800 r.p.m., but realizing that something was wrong and was affecting the speed I slowed down and noticed an awful skip. Upon pulling down the engine I found this piston which I am sending to you. I replaced it (No. 4 piston) and upon accelerating with another car about twenty miles after fixing it, I blew a hole in No. 5 piston, similar to No. 4, except it was not as large and was on the corner of the piston slightly away from the piston pin boss.

I have never had this trouble before and have run the engine in excess of these speeds, very often up to 5700 r.p.m. in second, where I encounter valve float, but I could not see a nick on either piston to indicate that a valve might have cracked the piston. Since I don't actually know whether the pistons were cracked or burned I will continue to give you all the evidence I can on this case so you will be able to come to the correct answer as to the cause.

I may possibly have my timing too high or it may have been the distributor could have slipped while operating at high speed and caused pre-ignition, but it seems that if this was the case it would have affected more than those two particular pistons. I was using an AC resistor plug in the car, if this could shed any light. Also, I do not think any foreign matter entered my motor as cleaners were intact and had not been tampered with.

Fig. 1. The hole in this piston is definitely caused by detonation, as the metal shows signs of having become very hot and the rings are actually baked in so tight they cannot be moved without destroying them. Also, the piston pin is frozen so tight it could not be moved when holding the piston in a vise and trying to move the rod. Also notice the two burned spots on the edge of the piston, which might have burned away if the hole had not first burned through the top of the piston.

I am planning on putting a '58 Corvette block in my '56 Chevy, so before I blow it up, please give me some information on my last expensive case. I will greatly appreciate it.—*W.A.D., Fernandino Beach, Fla.*

Answer: There is little doubt about the cause of the hole burned in the top of the piston. This is a good example of the damage that can be done by detonation.

The combination of conditions was just too much for the pistons to take, and just as the weakest link in a chain will be the first to break, this particular piston was the first to go. The Corvette camshaft plus the three two-barrel carburetors allowed the maximum amount of fuel-air mixture to get into the cylinders. With a compression ratio of 9.5 to 1 and a full mixture charge, the compression pressure was probably up to nearly 200 psi. The explosion pressure will be roughly four times the compression pressure, which in this case would make it nearly 800 psi.

Add to this the destructive force of detonation, which could be due to fuel with too low an octane number, hot cylinder deposits, ignition advanced too much, or a distributor that had a slipped breaker plate or other defect which could advance the ignition timing, and damage will result.

There were two nicks at the top edge of the piston which looked as if they had been touched with an acetylene flame. This gives further evidence that the hole in the top of the piston was due to detonation.

This particular car was used under extreme conditions, but passenger cars in ordinary service can also have trouble from detonation. When premium fuel is called for by the car manufacturer, by all means, this is the type of fuel that should be used.

Detonation under light loads is not usually much of a problem, as this will give notice to the operator that the fuel is not suitable for his engine at the given ignition timing; and therefore he should either start using the correct fuel or have his ignition timing retarded.

However, detonation that occurs at higher speeds of the engine presents a different problem. Unless the driver is unusually sensitive to engine sounds and operation, he will not notice the sound of detonation because of wind noise and road noises. Yet it is at these higher speeds that engine damage can occur if fuels of too low octane value are used, or if conditions of engine cylinder deposits or ignition advanced too far, happen to exist.

Detonation will cause hammer-like blows and excessive temperatures,

(Continued on page 70)

In the automotive service business...

THERE'S NO BUSINESS LIKE CHEVROLET BUSINESS!

BECAUSE... One out of every four cars and trucks on the road is a Chevrolet—more than any other make.

BECAUSE... You can make your Chevrolet dealer your one-stop source for the genuine Chevrolet parts you'll need to serve this market.

Nearly 16,000,000 Chevrolet cars and trucks on the road . . . a *big* service market!

Dependable Chevrolet parts are built of the same high quality material and to the same rigid engineering specifications as the original parts. They're made for a Chevrolet—and made to work together.

Your Chevrolet dealer can offer you service aids that can help you give better and more profitable service to Chevrolet owners. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

MAKE YOUR CHEVROLET DEALER YOUR PARTNER IN SERVICE...
HE IS READY, WILLING AND ABLE TO SERVE YOU!

GM
CHEVROLET
GENUINE PARTS

BY HERB CARRIER
Detroit Editor

Spokes from the "hub"

Attention all knuckle-busters! Lift up your heads and throw out your chests. No longer are you to be called grease monkeys, or even mechanics. At least one manufacturer—Ford Motor Company—will hereafter refer to you as *Service Technicians*. Congratulations! You deserve it. The skill it takes to properly service modern vehicles certainly warrants recognition in the nomenclature department. Let's hope that the idea catches on, and the man with the wrench gets the respect due him namewise—and *moneywise!*

* * *

Electric Auto-Lite has recently launched a training course for marine engine repair. This is good. The whole marine industry is growing by leaps and bounds. Even now many outboard motors are showing up in auto repair garages looking for service. This could develop into a good market for the aggressive repairman. If you need a little more information on what makes the outboards tick, and how to fix them, look into the Auto-Lite Marine Engine Course.

* * *

Looks like early announcement of all 1959 models. Could be the new models will start showing up late in August or early September. More gimmicks are in store, too. Some will require real specialized service.

* * *

The impact tool is safe for another year! This is especially good news for the dealership mechanic who does a lot of warranty work, but it actually affects all repairmen. 1959 time study for flat rate is just about completed on most '59 units. At least for the time being, manufacturers are looking the other way when someone uses a power tool. Flat rate prices will still be based on the use of ordinary hand tools. They should be. If a mechanic lays out $120.00 for a tool which will increase his efficiency, he should be able to earn extra money to at least pay for the tool. He has a greater investment and is entitled to a greater return.

* * *

There's an increased amount of interest being generated about the prospect of electronic controls for ignition systems. According to some reports, an independent engineering company is doing final research on such a device. The unit, as being developed, is aimed at truck use, but can be applied to passenger cars. Time will be here shortly—if it isn't here now—when the working mechanic will be forced to add a knowledge of electronics to his already bulging bag of tricks.

* * *

There's a new gremlin loose in the cooling system, through advanced design which offers compactness and greater heat exchange characteristics, coolant passages in the radiator and heater cores have been markedly reduced in size. Compared to the counterparts of only a few years ago, heater core tubes have been cut down to only a fraction of the former width and height. In addition, little serrations, which act as baffles, have been formed on the inner edges of the tubes.

Because of the small tube size, and because of the serrations, it's impossible to force a .015" flat feeler through the passages of a popular heater core.

Knowing this, some folk in Detroit are holding their breath when owners of cars that have been on the road for almost a year turn on their heaters for the first time this fall. They're hoping the small deposits that usually build up in the cooling system have not wedged in the heater tubes to block off circulation. This is a real live threat, especially if "old fashioned" stop leaks or rust inhibitors have been used.

The new cores cannot be rodded out as of yesteryear. If they can't be cleaned chemically, replacement is usually the only cure—and, as you know, this can be expensive. Be careful when recommending additives for current model cooling systems. Make certain that they will leave no deposits large enough to block up the system. Heater core tubes can be as small as .023".

Aluminum . . . the magic word this year . . . is also showing up in cooling system components. Caution is necessary again when using some anti-freeze solutions with aluminum. It's possible, through oxidation, etc., to set up a situation wherein the coolant violently attacks the aluminum.

* * *

Compulsory vehicle safety checks for all states is one of the most important goals of organized groups of mechanics and garage owners. Some states, Pennsylvania, for example, require such checks. Others, which include some of the states with extremely large numbers of registered vehicles, have little or no provisions to guard against mechanically unsound vehicles being operated on public roads.

More power to the pushers of this kind of legislation. With the steadily increasing number of units on the road, and the increasing number of sustained high-speed miles being piled up on freeways, expressways, and toll roads, there is a definite need for increased control over the mechanical dependability of cars and trucks put to this use.

A logical follow-up step to a mandatory, periodic safety-check would be to have the work performed by professional repairmen—not in the alley or under a shade tree. This might be unfair to some competent do-it-yourself mechanics, but they number relatively few in the over-all picture of the Saturday afternoon handymen who are over-anxious to tackle vast mechanical projects with the most half-vast ideas.

The handiest auto service flashlight ever!

TUNG-SOL®

FLASHTESTER

FEATURES OF THE HANDIEST AUTO SERVICE FLASHLIGHT EVER DEVELOPED

- lifetime magnet
- bulb & fuse tester
- ring hanger
- non-breakable lens
- no-roll cushioned head
- cushioned end cap
- weatherproof durite barrel
- bulb shock absorber

FREE WITH

$1.99 VALUE

ONE CASE (12 lamps) of 5400-S or 5040-S VISION-AID HEADLAMPS or . . .

TWO CASES (16 lamps) of 4001 or 4002 DUAL VISION-AID HEADLAMPS
(16 of one type, or 8 each of both types)

AT REGULAR PRICES!

Limited Time Only—Call Your Tung-Sol Distributor Today

LAMP DIVISION **TUNG-SOL ELECTRIC INC.** NEWARK 4, NEW JERSEY

Instrument corner

Conducted by The Instrument Man in the interests of simpler, faster, more satisfactory—and more profitable—service operations.

It Pays to be Suspicious

● THE TELEPHONE in the Instrument Man's office rang with a loud jangle. Answering the phone, he was greeted by, "Hello, is this Jim?" On being assured that it was, the caller continued, "Jim, this is Bob... and I've got a problem I must admit has me stumped! You know I can usually lick the tough ones myself... but I sure need your help this time."

Bob was one of the boys the Instrument Man was rather proud of, as he had personally coached him in the proper use of test instruments. This help, plus a natural aptitude for diagnosis work and a good background as a mechanic, made Bob much above average as a tune-up man, and as a result he was doing very well in his shop.

Asked what the trouble was, Bob replied, "A new customer came in this morning with a car that has only 4,000 miles on it. He told me he couldn't get it up over 70 miles an hour. He had it back to the dealer he bought it from, and was told that everything checked out, and the car was in good shape. He also took it to several other shops where they changed plugs, put on a new coil, and supposedly tuned the engine... but nothing seemed to help.

"I checked it over myself and everything seemed to test out OK, except one thing: When I put the distributor on my distributor tester it checked out perfect; but when I put it back on the car and tested it with my electronic distributor tester I only got a partial distributor advance. I pulled the distributor again and it checked out OK. Come over, will you, and see what you can find."

As soon as he could make it, the Instrument Man went to Bob's shop to see if he could help. Since Bob had tested the distributor twice on his tester, and he was a competent operator, there was no use in putting it on the stand again.

Together they hooked up the electronic distributor tester, and with the engine running they got the maximum advance that the distributor would give. It was quite a little under what total advance should have been, so the Instrument Man said:

"Either the automatic advance or the vacuum advance is not working as it should. You said that on the distributor tester they both worked satisfactorily. The automatic advance would not be changed by putting the distributor back in the engine, but it might be possible that the distributor is not getting the vacuum it should. Let's try disconnecting the vacuum line to see if that makes any difference in the total advance.

The vacuum line to the distributor was removed and the total measured again. There was no change from what it had been with the vacuum line connected. Then Bob got a bright idea. "Let's put a vacuum gauge on the end of the line to see how much we are getting." Connecting the gauge to the end of the vacuum line and starting up the engine again, had no effect on the gauge needle at all, indicating zero vacuum.

"There's your answer," said Jim, "but now the question is—Why." There were no visible leaks or breaks in the vacuum line, so the next move was to take off the carburetor, and examine it. Blowing into the hole where the vacuum line connects to the carburetor indicated that the vacuum passage was clogged up tightly. Closer examination disclosed that the vacuum passage had never been drilled out completely—so there was no vacuum connection open to the source of vacuum at all. The car had been running all the time with no vacuum advance!

There was nothing to do but put on a new carburetor, which was done. This made the car run and perform as a new car should.

The moral of this story is that the unexpected should be suspected on every job where inconsistencies show up.

WHY INSTRUMENT CORNER?

Because we know the help he's given so many shops first-hand is just as valuable in the re-telling as it was in the happening, we've asked The Instrument Man to pass along some of his more interesting experiences. As an old-timer in automotive servicing who is distinguished by the fact that he's kept up-to-the-minute on developments in his field, The Instrument Man gets many calls for help from friends, acquaintances and even strangers, in shops large and small. He generally solves the cases, because of his understanding and appreciation of trouble-shooting instruments.

. . . and It Pays To Test

● WHEN MAKING his routine periodic call on a customer, our Instrument Man was greeted with, "Boy, am I glad to see you!" by the operator of the shop. It seems that a four-year-old Buick had come into the shop with the owner complaining that he couldn't get it to run over 65 miles per hour. At that point it would flatten out and act as if it wasn't getting enough gas.

A new fuel pump was put on and the owner sent on his way. A day later the car was back again with the complaint that the new fuel pump didn't make any improvement.

"Did you test the fuel pump in the first place?" the operator was asked. No, he was sure it was the fuel pump, so why bother to test. He had been fixing cars for twenty years and he knew the symptoms.

The Instrument Man "just happened" to have one of the new fuel-pump-pressure and delivery-volume testers in his car, so he brought it in and connected it to the new fuel pump. The engine was started up, and the pressure was somewhat below what it should have been, but the volume was only about half of the normal amount specified.

A previous experience with this model car came to the Instrument

(Continued on page 77)

EVERY PART FITS RIGHT!

Wagner® Lockheed
HYDRAULIC BRAKE PARTS
FOR REPLACEMENT NEEDS
...are identical to original equipment

YOU CAN DO BETTER, FASTER BRAKE WORK WITH THESE PARTS . . .

Wagner Lockheed Brake Parts—cylinders, pistons, springs, washers, cups, boots, hose, etc., marketed for replacement needs are identical to original equipment. These parts are manufactured to the same specifications, by the same machinery in the Wagner factory, as Wagner-made parts used in complete assemblies for original equipment.

Throughout every stage of factory production Wagner exercises rigid quality control over these products. Parts are inspected and checked by experts to make sure that only top quality parts are furnished to you. This is done to provide you with the finest brakes available anywhere.

Remember, safe brakes protect lives.

You'll find that the Wagner Lockheed line of hydraulic brake parts is the most complete on the market. Parts are available individually or in factory sealed kits. Cylinders are supplied in complete assemblies, or parts can be purchased separately.

For details, consult your nearest supplier of Wagner Lockheed Parts, Fluid and Lining, or write for a free copy of Catalog AU-500.

Wagner Electric Corporation
6443 PLYMOUTH AVENUE, ST. LOUIS 14, MO., U. S. A.
(Branches in principal cities in U. S. and in Canada)

WP58-4

Wagner Lockheed
the best known name in brake service

LOCKHEED BRAKE PARTS, FLUID, EXCHANGE SHOES and LINING • AIR HORNS • AIR BRAKES • TACHOGRAPHS • ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES

MoPar fuel pumps and carburetors?

Why always MoPar?

Because they're precision-engineered by Chrysler Corporation to fit Plymouth, Dodge, De Soto, Chrysler, Imperial and Dodge Truck fuel systems. Result: less installation time, lower customer labor bills, more service time for *additional* business.

MoPar means original equipment standards, to work in perfect balance with all other component parts. Result: your customers get better, longer performance, you build your *own* service reputation.

MoPar supplies your "bumper to bumper" requirements for all Chrysler-built vehicles. Get immediate delivery of any MoPar part by calling your MoPar Wholesaler or your Plymouth, Dodge, De Soto, Chrysler or Imperial dealer.

Sell the line that keeps your customers sold on you—MoPar

MoPar PARTS AND ACCESSORIES

MoPar Division, Chrysler Motors Corporation, Detroit 31, Michigan

Editor's page

Cutting corners—and costs

● TALK WITH A MECHANIC, especially an old timer, and you invariably learn that he had many a trick up his sleeve for doing a specific job on this or that car in less time than ordinarily allotted. This is a natural outcome from having done the work many times in the past.

There was a time, too, when the old timer was willing to pass on to a less experienced mechanic many short cuts which saved time. Along with this he would explain shop practice, which, with the cutting down of time, assured a satisfactory job to the customer and rightful profit for the shop.

We could stand more of this old timer type of willingness to pass along tech know-how and cutting corners, especially to young new-comers in the business. Many of these have, perhaps, taken a basic course in automobile mechanics and have chosen motor vehicle servicing as their vocation.

The "secrets" of the trade when known to many help everybody. It is recognized that there are many service departments and shops that stage regular meetings with mechanics for the purpose of gaining all-around shop efficiency. Often the service manager, shop foreman or owner is in charge. Such meetings gain and hold men—so important to-day in the light of manpower shortage.

Various sources for procurement of short cut and cost cutting information are available. Many tool and equipment manufacturers, for example, have fieldmen regularly visiting shops where mechanics are constantly surrounded with jobs they must do expertly; and do them right the first time for customer satisfaction. These tool salesmen, usually expert mechanics themselves, sense the need for certain special tools; often let the mechanic use it right on the job.

A wealth of helpful service material is available from motor vehicle manufacturers, from parts makers, associations and general automobile service equipment manufacturers. Nor should the shop overlook the trade publications—sources for divulging theory, technical and management information that must precede the "cutting corners" phase to gain ultimate cost cutting for insuring the operation of a profitable service business.

Ben Ikert
EDITOR

AUTOMOTIVE TECH KNOW-HOW

Single and two-plane balancing

Vibrations caused by uneven weight distribution in rotating parts are not only damaging to such parts, but more often to mountings, bearings and other supporting members. Balancing and weight correction insure maximum power, speed, fuel economy and overall smooth operation.

By BEN M. IKERT
Editor

• A ROTATING PART, such as a flywheel, crankshaft or gear, in which the weight is evenly distributed, is in balance. Conversely, uneven weight distribution produces unbalance.

When an unbalanced part is placed in motion the unbalance takes on a sinister role of power—actually wasted, uncontrolled power.

The stresses and particularly the vibrations set up by unbalanced parts, aside from being annoying, are damaging to the parts themselves and more often, to the supporting parts. Vibration, though not discernable may exist, but is being absorbed by mountings, bearings or other supporting means. This destructive effect goes unnoticed until wear—often premature—of vital parts is evidenced. In extreme cases actual failure of parts occurs.

Consider two rebuilt, identical engines. The customary new parts have been installed in both engines. In one engine, however, let's assume the rotating parts—crankshaft, flywheel assembly, etc.—have been completely balanced and weight corrected. In the other engine this was not done. This leaves no doubt in anyone's mind as to which of the two engines will be the smoother in operation over the entire speed range.

The importance of balancing is brought into sharp focus by the history of the Indianapolis 500 race cars. For many years the same Offenhauser engines, with no change in size have quite consistently boosted the average miles per hour. What's the answer? Accurate balancing of rotating parts in the engine and drive lines. Absence of vibration permits higher r.p.m.'s and insures that parts stay put.

How important is balancing in the passenger car engine? A study of the table "Forces Created by One Inch Ounce" is revealing. Notice that even so small an amount of unbalance indicated by 1 oz. only 1" away from the center of the axis in a rotating part becomes 2 lb. 10 oz. at 1200 r.p.m. At 2500 r.p.m. the 1 oz. of unbalance becomes 11 lb. 6 oz.!

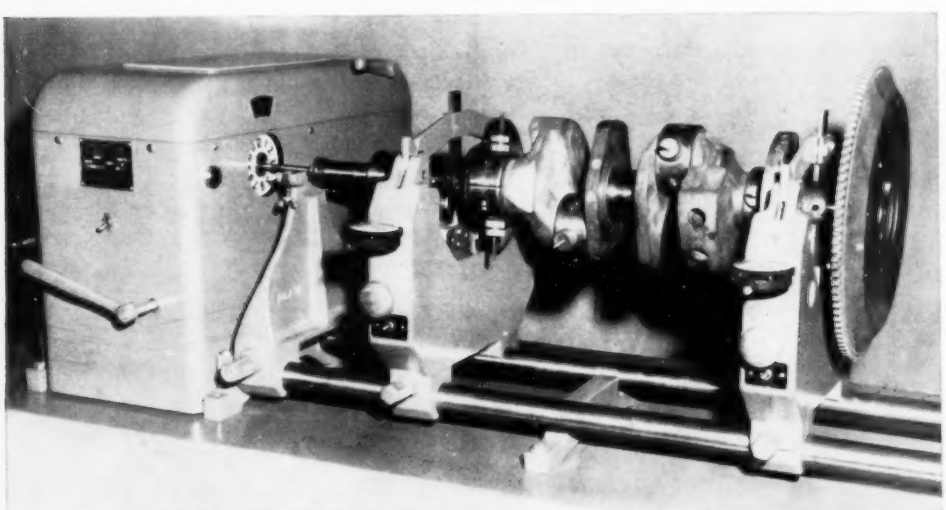


Fig. 1. Set up for balancing a V-8 engine crankshaft with flywheel attached. Bob weights are fitted to rod bearing journals.

The effect of this increase in weight is like the greater pull you get when revolving a stone faster and faster on the end of a string. With a longer string the pull becomes even greater. The disposition of the weight (stone) further from or nearer to the center of rotation and the speed of rotation constitute a quantity called its angular momentum. This is the gremlin that causes vibration and destructive forces in unbalanced rotating parts. However, corrections easily can be made through balancing with modern equipment (Fig. 1) the operation of which can be readily mastered by the shopman. Understanding some of the fundamentals of balancing helps to bring this about.

When, for example, a metal disc with a heavy spot located at a point outside its center or axis is placed on knife edges, the disc comes to rest with the heavy spot

Forces Created by One Inch-Ounce Unbalance at R.P.M. Indicated

R.P.M.	*Lb.*	*Oz.*	*R.P.M.*	*Lb.*	*Oz.*
200	0	1.18	1200	2	10
250	0	1.83	1300	3	1
300	0	2.63	1400	3	9
350	0	3.58	1500	4	2
400	0	4.70	1600	4	10
450	0	5.90	1700	5	4
500	0	7.30	1800	5	14
600	0	10.60	1900	6	9
700	0	14.35	2000	7	5
800	1	3.00	2500	11	6
900	1	8.00	3000	16	7
1000	1	13.00	3500	22	9
1050	2	0.00	4000	29	3
1100	2	3.00	5000	45	10

downwards, Fig. 2. It will continue to do this until a counterbalance weight, exactly the same size as the first, is placed directly opposite; or, sufficient metal can be removed from the heavy side to balance the disc.

Another way to counterbalance is shown in Fig. 4. Here a heavy spot indicated by the 8-oz. weight is placed 3″ from the axis and amounts to 24 in.oz. (8 oz. x 3″). This is shown counterbalanced with a 4 oz. weight placed 6″ from the axis and 180° away from the 8 oz. weight.

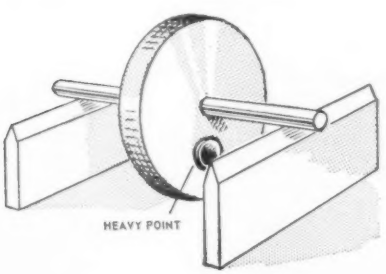


Fig. 2. Unbalanced disc on knife edges. Heavy spot turns disc which comes to rest with the heavy spot at the bottom.

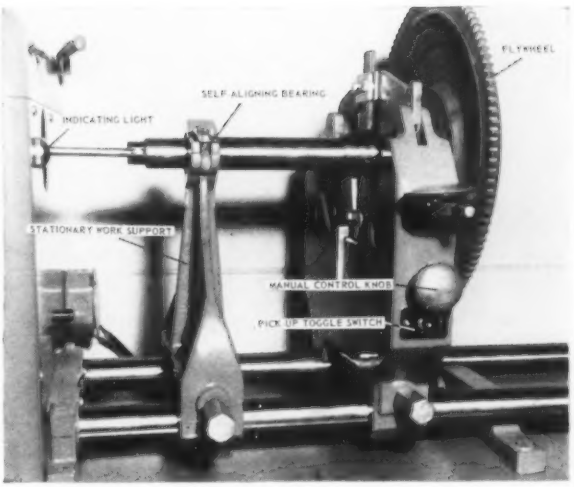


Fig. 3. Single plane set-up for flywheel balancing using a master arbor and adaptor to which the flywheel is fastened.

Placed 6″ from the axis, the 4 oz. weight also is equivalent to 24 in.oz.

The foregoing examples apply to a disc (single plane) but when considering a cylindrical piece supported on axles at the ends other factor of balancing in two planes must be observed. Thus, in Fig. 5 (top-view) an 8 oz. and 4 oz. weight are shown in the same plane but at opposite ends of the cylinder. Even though both are equivalent to 24 in.oz. the cylinder is not in balance.

If the cylinder is revolved at speed a twisting action or rocking couple is set up. It's like the stone on the end of a string, each weight is tending to pull outwards, shown by the arrows in the middle view, Fig. 5. By adding the additional weights (4 oz. on the left end of the cylinder and 8 oz. on the right end) the cylinder is balanced and will revolve without vibration or distortion.

The balancing machine illustrated is made in a variety of sizes and capacities to handle a wide range of rotating parts. One popular model consists of a left and right hand work support, each of which contains adjustable rollers. This type machine is generally used for two plane (dynamic) balancing of parts such as crankshafts, armatures, rotors, and any and all other parts that operate in their own unit between bearings.

Another model has a left hand stationary work support equipped with a self-aligning bearing and a right hand work support equipped with rollers (Fig. 3). This type machine is generally used for the single plane balancing (rotating static) of parts such as pump impellers, fan

(Continued on following page)

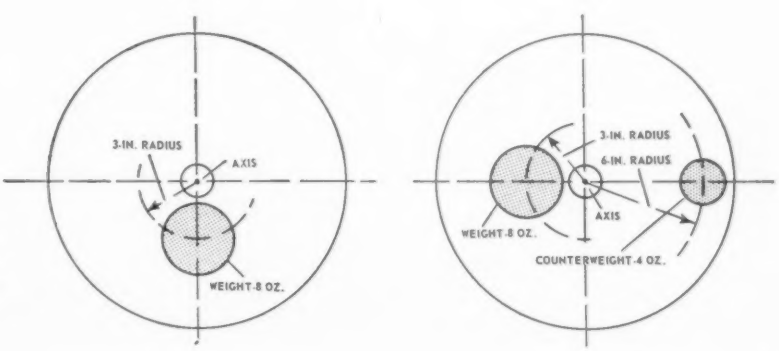


Fig. 4. An 8-oz. weight placed 3″ from the axis center causes an unbalance of 24 in.-oz. This can be counterbalanced with a 4-oz. weight placed directly opposite (180°) on a 6″ radius.

Balancing . . . CONTINUED

blades, flywheel, clutches, and other parts that generally operate in an outboard or overhanging position.

The work supports are laterally adjustable along guide rods and ways with locking devices for clamping them in place.

The flexing head beams are light in weight proportionate to weight load range. The flexing head beams are suspended, pendulum fashion, by linkage which in turn pivots from knife edges and sensitive bearings. These flexing head beams are equipped with adjustable rollers, alternate designs being available for vee blocks and half bearings. The flexing head beams, linkages, etc., are not dampened in any manner, true pendulum action existing at all times.

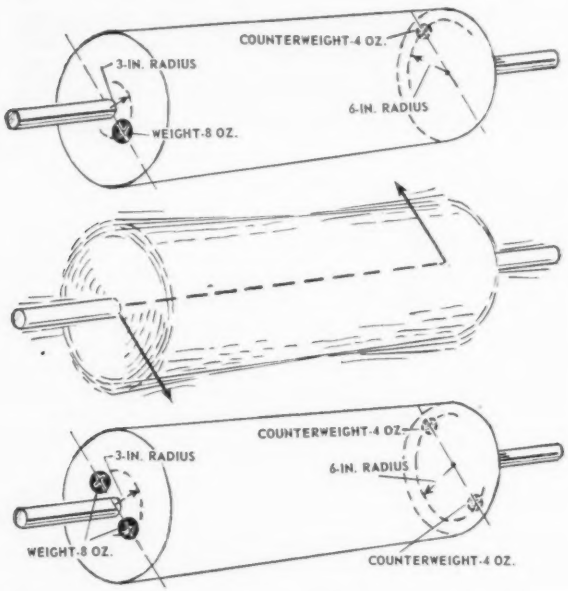


Fig. 5. Top view shows an 8-oz. and 4-oz. weight in the same plane but at opposite ends of a cylinder. Obviously both weights as placed are equivalent to 24 in.-oz., but located as they are, a twisting action occurs due to unbalance when the cylinder is revolved. Adding the weights (lower view) corrects the unbalance.

Most models of these balancing machines have dual pick-up controls, automatic and manual. Platinum contact points in the circuit of a heavy duty power unit "fires" a strobe light to indicate the position of unbalance.

Several combinations of drive and drive motor are used for the power supply and all machines are shaft drive, although a belt drive attachment is available for certain models. Power supply generally used is a single speed motor and four speed transmission, a variable speed drive unit, or a D-C type motor drive.

Mechanical full jeweled type dial indicators having a 1" range of magnification are used. The small, high intensity strobe light mounted behind the transparent number disc indicates the position or spot to add weight ("light" point). The numbers on the same disc are used for locating the position of unbalance in relation to the part. Correction can be made in either the vertical or horizontal plane—depending upon the method of correction.

A selector switch enables the operator to select the correction plane in either the left or right hand work support.

Electrical impulses from the pick-ups are greatly multiplied and accurately transformed into positive indications of magnitudes and positions of unbalance.

OPERATION OF MACHINE

Fig. 8 illustrates schematically the basic operational theory of the balancing machine. Operation varies slightly with the different models, but basic procedure applies to all.

The workpiece, a crankshaft for example, rests on adjustable roller bearings, the latter being supported by the flexing head beams. The head beams are suspended in the work supports through suitable linkage which allows free floating movement of the flexing head beams in a horizontal plane.

As the drive shaft rotates the workpiece the unbalance (centrifugal) force causes the workpiece and its supporting means to vibrate. These vibrations are transmitted from the workpiece through its supporting mechanism and then to the contact points. The insulated platinum contact point is mounted on a grounded support.

When contact is broken between the contact points,

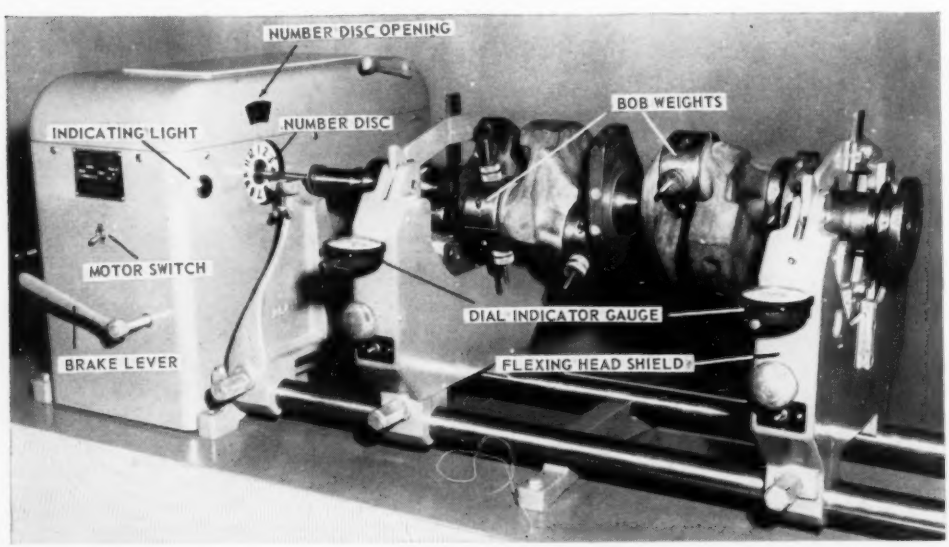


Fig. 6. Every new or reworked crankshaft should be checked for unbalance and correction made if necessary to insure smooth top performance. Shown is a two-plane set-up for a Ford V-8 shaft.

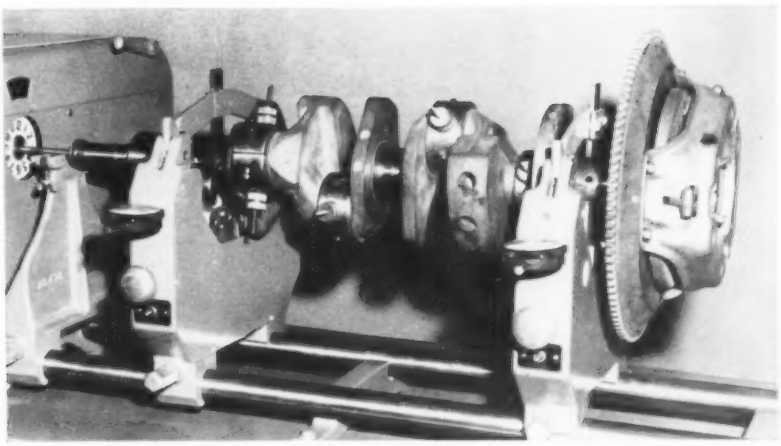


Fig. 7. Balancing a crankshaft to which the flywheel and clutch have been attached. Balancing speed is fairly low—520 r.p.m. to avoid center main bearing deflection.

an electric impulse is generated and the resulting signal is conducted through the pick-up leads through the power unit to the strobe light, which, when it is "fired" indicates the "light" point on the workpiece. That is, the strobe light flashes through the plastic number disc to indicate the position of unbalance on the workpiece.

The translucent plastic number disc makes it possible for the number, or numbers, indicated to be easily seen as the stroke light is "fired."

The number disc opening in the control cabinet of the machine allows the operator, on machines equipped with a drive shaft, to easily locate the position of unbalance on the workpiece. The operator merely switches off the motor to stop the machine and then revolves the workpiece by hand until the previously "strobed" number appears in the opening in the control cabinet. Correction for unbalance is then made in the same plane on the workpiece, as explained later.

The function of the indicating light on the drive head housing is to indicate a ground in the pick-up circuit. During balancing operations the light does not glow. It will glow if these conditions occur:

(a) Either manual control knob turned too far clockwise.

(b) Ground exists between the contact rod along the side of the machine and the rear guide bar. (Could be caused by a tool or any piece of metal, wedged between the contact rod and guide bar.)

BALANCING SPEEDS

It is not necessary to balance a part at its operating speed, unless the part does not distort or deflect at this speed. The best procedure is to balance the part at the lowest possible speed as it enables the operator to get the part up to speed and stop it more quickly. This reduces the balancing time cycle.

The recommended balancing speed for passenger car and light truck engine crankshafts, for example, is 520 r.p.m., with nothing in excess of 600 r.p.m. The reason for this relatively low balancing speed is to avoid possibility of center main bearing deflection. Even racing and

(Continued on page 22)

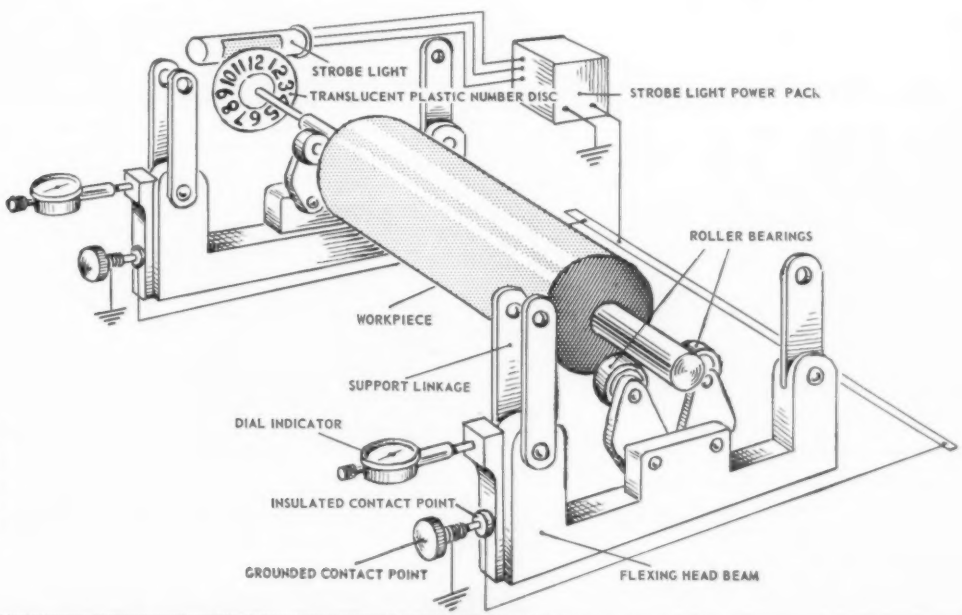


Fig. 8. Schematic drawing of a balancing machine capable of handling a wide range of rotating parts. The theory of operation is explained in text.

AC SELLING SLANTS
MONEY-MAKING FACTS

DEALERS ACCLAIM...

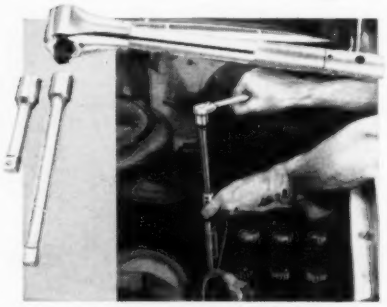
these BIG AC "Hits"

time-saving AC Spark Plug TOOL KIT

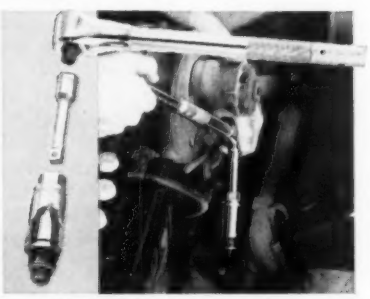
Dealers say: "Just the ticket for speeding spark plug removal and installation" . . . and only $13.21* to dealers for this package valued at $25.56.

Dealers appreciate this high quality Tool Kit

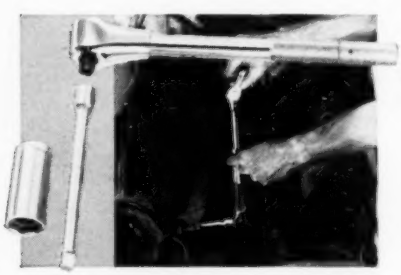
...HERE ARE 5 BIG REASONS...



1 Extensions provide easy plug removal from 90% of V-8's without disconnecting power units.



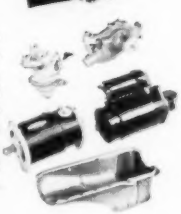
3 Rubber Socket Retainer holds plug, no need to "climb into" the engine during installation.



2 Extensions permit service immediately without waiting for "cooling off" period . . . no more burned hands on hot manifolds.

4 Valuable time saver . . . makes tough jobs easier . . . cuts labor time as much as 50%.

5 In addition to speeding service on *all* plug jobs, this 7-piece tool kit is a big help for working on pumps, generators, starters and oil pan removal.



ORDER YOUR AC

FM-36

TOOL KIT PACKAGE

from your regular AC supplier today!

the FM-36 package includes:

- **High Quality AC Spark Plug Service Tool Kit**
- * **One 8-pack of AC Spark Plugs (Type 85TS) worth $8.24, when sold, reduces your initial investment of $21.45 for the Package to the low net of $13.21.**

GET ALL THE TOOLS to do the job!

OF THE MONTH !

FOR DEALERS

of the Selling Season!

AC Marine Spark Plugs in the New Waterproofed "SPARE PAC"

"Boat owners are really going for ACs in the 'Spare Pac'." That's the big success story from dealers stocking this AC "first" in spark plug packaging.

It's the new way to sell spark plugs . . . AC's famous rust-proofed plugs in the smart new waterproofed containers provide an unbeatable sales combination.

"Spare Pac" Container folds flat for convenient storage.

Here's why:

- Each plug sealed separately in waterproofed, transparent plastic enclosure to assure factory freshness.
- Eight plastic-enclosed plugs mounted on merchandiser that carries a selling message.
- Merchandiser perforated for convenient tear-off of individual plugs . . . sell one to eight.
- Merchandiser punched for traffic area display . . . where every customer can see it.
- "Spare Pac" Merchandiser encourages impulse buying . . . quick purchase of extra spark plugs.
- Waterproofed package encourages customers to carry a spare in their tool or tackle box.

Garden Power Units, Too!

Attention Power Mower and other Power Unit dealers! AC offers a complete line of 2 and 4 cycle engine spark plugs. Stock up now. Display banner below for more spark plug sales.

ALL TYPES AVAILABLE from your regular AC supplier

Watch Walt Disney Studios' ZORRO every week—ABC-TV

AC SPARK PLUG ❀ THE ELECTRONICS DIVISION OF GENERAL MOTORS

AC **SELLING *SLANTS***

MONEY-MAKING FACTS

Hot Weather means

FOR

AC

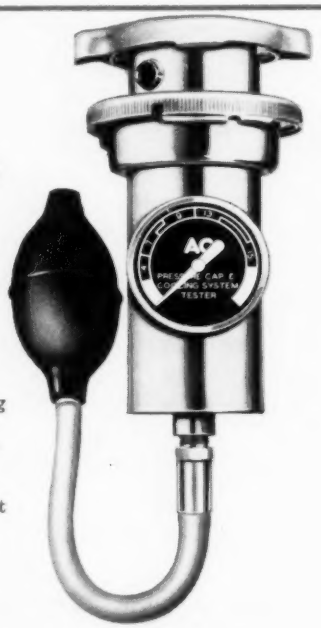
PRESSURE CAPS

Soaring summer temperatures can result in poor engine performance for motorists with "tired" pressure caps. "Tired" caps that can't hold their rated pressures often contribute to engine overheating and power "ping". Unfortunately, your brand of gasoline might get the blame. Surveys show that 6 out of every 10 of your customers are in need of a new pressure cap.

Two AC Sales Tools to Help You Convert Hot Prospects into Satisfied Customers

FAMOUS AC PRESSURE CAP AND COOLING SYSTEM TESTER FOR ONLY $10.00.

This carefully calibrated device detects cooling system leaks and faulty caps in a matter of seconds. A fast reading of Tester by the customer quickly closes sales for caps, hoses, hose clamps or other needed cooling system replacement parts. So capitalize on the tremendous potential market for pressure cap replacement. Get your AC Tester and start a regular checking program. Dealers who have done this report big sales gains for cooling system parts.



AC TESTER RACK AND "HOT PAD" MITTEN . . . two valuable service items are yours with an order for the FM-20 Cap Assortment or *any* 12 AC Pressure Caps. The package includes an all-metal AC Tester Storage Rack for wall or pump island mounting, plus a heat-resistant AC "Hot Pad" Mitten for removing hot caps.

You buy the 12 caps at the regular price, plus $4.05 for the Rack and Mitten. Included with the Rack are 3 AC Pressure Caps, type RC-9, which are worth $4.05 at retail. When you sell these 3 caps you recover the total cost of Rack and Mitten.

AVAILABLE FROM YOUR REGULAR AC SUPPLIER!

OF THE MONTH !

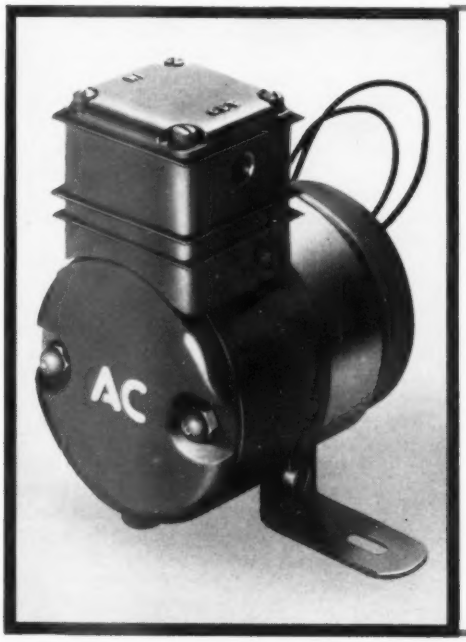
FOR DEALERS

Hot Prospects . . .

FOR AC ELECTRIC FUEL PUMPS

Vapor lock—the old summer bug-a-boo—can now be virtually eliminated with the new AC 6 or 12 Volt Electric Fuel Pump. This quality pump can be used either as a booster to the conventional mechanical pump or as a replacement.

Booster installation is recommended where vapor lock or greater fuel demand is encountered. The electric pump can then be actuated by a dash panel switch by the driver when these extreme conditions develop.



The AC Electric Fuel Pump for Automotive, Truck, Marine, Stationary Engines 6 and 12 Volt Systems

A rugged dependable new type pump specially designed for heavy duty operations. Long life *rotary* type electric motor insures safe and reliable functioning under all operating conditions. Easy-to-follow installation instructions and versatile mounting bracket included with each pump.

	1 to 5	6 or more
LIST	$25.50	$25.50
YOUR COST	17.85	15.30
YOUR PROFIT	***$ 7.65***	***$10.20***

AC Spark Plug ❀ The Electronics Division of General Motors

Watch Walt Disney Studios' ZORRO every week over ABC-TV

Balancing . . . CONTINUED

drag engine crankshafts operating considerably over 5000 r.p.m. can be satisfactorily balanced in the 500-600 r.p.m. range.

TWO-PLANE BALANCING

Crankshafts and other parts that operate as a unit between bearings are given a two-plane balance for removing the dynamic couple caused by unequal weight distribution along the axis. The two-plane balancing also balances the crankshaft statically. During the operation the crankshaft, located on its front and rear main bearings, rests on the rollers of the work supports. Both flexing head beams and roller assemblies are free to oscillate transversely in their respective work supports. The recording mechanism of the right and left work support is used alternately when balancing by the two-plane method.

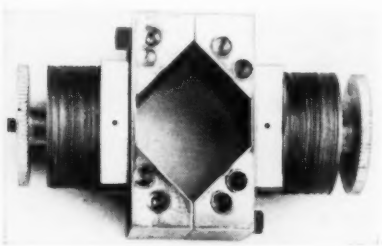


Fig. 9. Universal type bob weight which has a journal diameter range of 1⅞" to 2⅝".

BOB WEIGHTS

The design of a V-8 engine crankshaft, where the counterweights are 90° apart, necessitates the use of a bob weight for each connecting rod journal. The bob weight (Fig. 9) which represents a percentage of the total weight of two complete piston and con rod assemblies for each journal must be assembled to the crankshaft journal before a V-8 engine shaft is balanced. Thus, four bob weights are required on a V-8 shaft.

Most straight 4, 6 and 8-cylinder crankshafts, which have counterweights 180° apart, require no bob weights.

If the operator is uncertain about the need of bob weights on a crank, the latter can be placed on the machine's rollers, locating on the front and rear main bearings and without the machine drive shaft connected. Then, the crank is given a quick spin by hand. If the flexing head beams on each work support slam against the beam stops and the crank tends to jump out of the machine, indications are that bob weights are required. But if the crank, when spun, settles down and rotates smoothly, bob weights are not required. This procedure is to be used only with cranks which have previously been used in engines or with replacement stock cranks.

The bob weights included with the balancing machine are suitable for a great variety of crankshafts and by use of half bearings, shims and other modifications can be applied to many more cranks.

If bob weights are used everything must be kept uniform and equal. When adding counterweights to the bob weight studs, the weights must be equal and also of equal thickness so that the weight from the outside diameter of the bob weight is equal on both ends, 180° apart.

Also, when bolting the weights to the journal the gap between the halves of the weights must be the same. If the weight is used on a journal which is wider than the width of the bob weight, the latter must be centered so the spacing between the journal shoulder and the weight is equal.

DETERMINING WEIGHT

Where it is necessary to obtain the rotating weight which must be added to the crank journals by way of bob weights a definite weighing process is followed. Precision equipment, such as illustrated in Fig. 10, can be used for this. Once the weighing data have been compiled they can be kept for future reference for these crankshafts.

The general weighing procedure is to first weigh the piston pins individually. In the event a weight variable is found, separate the light piston pins from the heavier ones.

Weigh all pistons and select the lightest. Match heavy piston pins with light pistons and light piston pins with heavy pistons. By matching it may be possible to keep pistons and piston pin assemblies more nearly equal in weight, thus reducing the amount of stock removal required to balance. Remove weight equally from each piston pin boss or from the bottom inside of the skirt in the form of a chamfer until all piston and piston pin assemblies weigh the same as the lightest within a ½ gram tolerance.

Weigh reciprocating end of all connecting rods and select the lightest. Remove weight equally from the piston pin boss end until all weigh the same as the lightest, within a ½ gram tolerance.

Weigh the complete connecting rod, and select the lightest of the set. Remove weight equally from each connecting rod bolt boss or from connecting rod cap (if pad is provided for this purpose) on rotating end until all weigh the same as the lightest connecting rod within a ½ gram tolerance.

Finally, subtract the reciprocating weight from the total weight, thereby obtaining the rotating weight.

When operating either the automatic or manual controls, each work support is operated independently of the other. Thus, when operating the left hand work support, the toggle switch lever on the right hand work support is in the center or neutral position and vice versa.

Assume the machine is set-up for balancing a 6-cylinder crankshaft. With the motor switch "ON," the machine started and the crank gaining speed, the dial indicator on each work support is noted. Indicators show amount of unbalance in thousandths per inch.

With the crank rotating, move the toggle switch on the right hand work support into "automatic" position. (Left toggle switch is in neutral or center position.) Now note the number or numbers registered in the drive head housing opening. Return toggle switch to neutral and repeat the procedure with the left hand work support.

With the numbers registered on each end of the crank in mind, observe the total amount of movement of the dial gauge needles which movement measures, in thousandths, the total back-and-forth movement of the flexing head beams.

Assume the total indicating gauge needle deflection is .020" on each work support. Also, assume the number registered from the right hand work support is 12 and the number from the left support is 6. The machine is stopped and temporary weight correction made.

For temporary weight correction material such as Body Calk, Auto-Calk 400, Mortite and Slatite are suggested. These materials have the tenacity of wax and the weight of molding clay. They stick well at high speeds, providing the part being balanced is free of grease and oil.

The work is turned so number 12 is in the top position. Next, you proceed across the center line of the crank to its extreme right end and add weight at this

point in line with number 12. Again turn the work so number 6 comes to the top, adding weight to the extreme left top end of the crank in line with number 6.

With the correction weight in position, the machine is again operated. If the amount of correction weight is sufficient, the dial indicator needles will drop from .020″ deflection to within .002″-.005″. The original procedure with the toggle switches and work supports is repeated. With the dial indicator reading of .002″-.005″, three to five numbers should be registered.

On the second cycle the numbers probably will have shifted from their original positions. And, if too much weight has been added the numbers will appear 180° from the original starting position.

Assume the numbers registered on the second cycle from the right hand work support to be 12, 1, 2, 3, 4, etc. Then, without changing the amount of correction weight, slide the weight in the direction the numbers moved. The distance the weight will be shifted depends on the diameter, of the workpiece—the smaller the diameter, the less the shift and vice versa.

If the amount of shift is correct, the indicator gauge needle will show less deflection on the next cycle. Also, a check with the toggle switch on the right hand work support will show nearly all numbers appearing in the drive head housing opening. If the indicator needle shows about .001″ deflection, the toggle switch check on the right hand support will probably show numbers 10, 11, 12, 1, 2, 3 and 4. In this case a small amount of weight is added to the original weight. If numbers 4, 5, 6, 7, 8, 9 and 10 are shown, the weight is slightly decreased.

The original correction weight must never be removed and placed in another position. It must always remain near its original position, to be shifted only enough to again correct angular position.

A similar reaction will occur on the left hand work support, the difference being that the activity will center around the number 6, namely 6, 7, 8, 9, 10, etc.

The more numbers registered in the opening the first time the crank is rotated, the better the inherent balance of the crank and the less need for corrective weight. The fewer the numbers registered is an indication that the crank is severely out of balance and more corrective weight is needed.

For commercial balancing a registration of seven numbers is considered good practice. On the other hand, if a nine, ten or twelve number registration is desired or required, then the time cycle in balancing doubles and triples because of the departure from the practical to perfect balance.

CORRECTION OF CRANK

After a crankshaft has been balanced with the temporary weights, final correction is made. When doing this on one end of the crank, the operator should not disturb the temporary weight on the opposite end.

Correction of the crank is generally done by drilling in the extreme left hand and right hand counterweights; however, correction may also be made by grinding, milling or welding. At all times try to confine correction to counterweights. Weakening of the crank may result if correction is made on the journal side of the crank which is inherently the weaker side. Should it be found that the counterweight side is the lighter side it is suggested lead be added at the bottom of a drilled hole and the hole welded shut. This makes the counterweight side the heavier side—and also makes it possible to drill or remove from the counterweight side.

The crank can be drilled in the machine. Flexing head beam lock pins are provided for locking the beams while drilling. This eliminates all transverse movement of the beams. The use of the pins is recommended when loading and unloading the cranks in the machine. It is suggested wipe rags be kept over the journals and machine rollers to prevent drill chips or grinding dust from getting on the rolling surfaces.

Drill attachments are wide and varied, and it is generally left up to the customer to provide whatever may be most suitable for his particular shop. The least

(Continued on page 72)

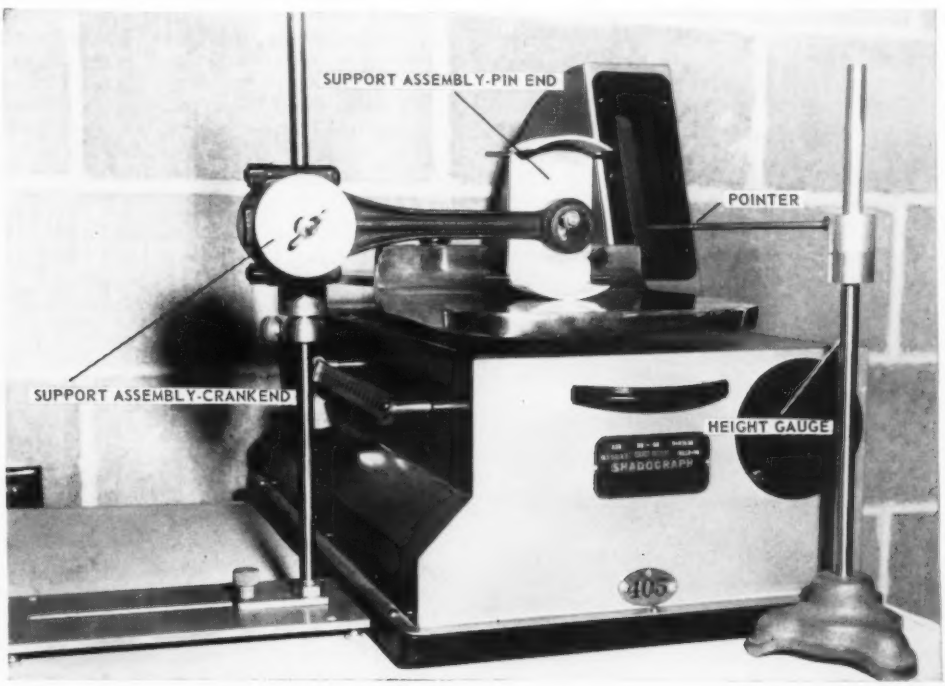


Fig. 10. Apparatus for weight balancing the reciprocating ends of connecting rods. Reciprocating weight is subtracted from rod total weight to get the rotating weight. Data are used for bob weight determination.

Fig. 1. Miracle Mile Motors, located near Delray Beach, Fla., features extra wide drives and abundant parking space.

Possessing technical know-how, the right equipment and a well-planned shop, a former mechanic and service manager proves that there is money to be had from . . .

By C. P. EDWARDS

One-stop service

● IN A RECENT Shop Management article, it was pointed out that the ease with which your customers can drive into your shop or out of it will have much to do with your shop volume. And the ease with which your mechanics can get needed equipment on the job—or parts for the job—will influence very directly how profitable your business will be.

While driving in the vicinity of Delray Beach, Fla., recently, the writer suddenly found it necessary to locate a service shop to take care of an engine that decided to get temperamental. Keeping an eye open for a likely place to pull in, the welcome sight in Fig. 1 suddenly came into view. But don't jump to the conclusion that this is a gasoline station with a shop. It is a gasoline station—and a good one. But it is also a shop—and one of the best that the writer has seen in many years of travelling.

ROOMY, CLEAN, WELL-EQUIPPED

One of the mechanics promptly came out to the car, and after listening to my tale of woe, directed me to drive the car into an empty service stall so he could diagnose the cause of my trouble. Upon getting out of the car so the mechanic could get to work, I was immediately impressed by this organization's layout—it was roomy, clean and well equipped; just the type of service operation that would be bound to attract customers.

Leaving the mechanic to the job at hand, I looked up the owner in the hope that he would be willing to spend a few minutes with me to talk about his set up . . . and he was; in fact, he was proud to talk about his organization, and rightly so.

Fig. 2. The shop's tune-up department is extremely well equipped and laid out for easy accessibility, as evidenced in . . .

Fig. 3. . . . which shows how double doors on all service stalls permit finished cars to be driven straight out.

The owner and operator of Miracle Mile Motors turned out to be a Charles H. Huck, an amicable, pleasant host. Upon delving into Mr. Huck's background, it came out that he spent many years in the New England area, first as a mechanic, and then as service manager for Cadillac. Later he was a field representative for United Motors Service. So when he decided to open a shop of his own, he knew from years of experience just what was good and what was no good.

OVERALL LAYOUT IS IDEAL

And there is so much that is basically good about Charlie's set-up that while few shop owners can duplicate everything that Charlie has done, most can get some valuable ideas that can be applied. And the overall picture is really something to dream about.

But a word of warning. Don't discount this shop because it does have natural advantages from the standpoint of climate. We have seen shops very similar to this on the outskirts of New York City and Salt Lake City. And, of course, there are others.

The first step that Charlie took when he planned his shop a few years ago was to get enough land. Admittedly that's not always easy, and in some areas the expense could not be justified.

The caliber of this shop can be judged rather accurately by the quality of the tune-ups performed, so let's move up a little closer on the service department which, as we see in Fig. 3, is practically bulging with business.

Incidentally, at this point it might be well to emphasize that it is not necessary for a car to back out of the service stalls that we see in Fig. 3. Actually the property of Miracle Mile Motors extends through from its location on Federal Highway 1 to another street a block west of the building. There is sufficient space for a car that has been serviced to pull straight ahead through the building and either continue to the next street, or by way of a wide drive to complete a U-turn and come back to the front of the building.

No small part of the layout is the arrangement of signs, a few of which are seen in Fig. 4. While it is natural and understandable that Charlie would go in a big way for service on Cadillac and Buick cars, as we note in Fig. 4, he gets a big run of business on all makes. And some day we'll try to bring you the story of how he makes time payments on big repair jobs easy for the customer and profitable for himself. Note the emphasis given to time payments on the sign suspended above the gasoline pump in Fig. 4.

But now let's go into some of the details of this profitable busy shop.

ALWAYS NEAR, BUT OUT OF THE WAY

A fundamental that seems to prevail here is to have everything needed located as close as possible to where it will be used, without being in the way.

For example, close to one of the hoists, and handy for the profitable job of muffler, exhaust, and tailpipe replacement, is the oxy-acetylene welding and cutting outfit in Fig. 5. By having really wide doors and passages, equipment of this kind is kept near the job, but out of the way when not in use.

Charlie knows full well that there is really a triple value in good equipment. Its presence impresses the customer with the ability of the shop. Its availability speeds the jobs that it helps sell. And finally, it is handy to prove to the customer that he really got what he paid for.

This is why the precision and specialized equipment for wheel alignment, valve service, tune-up, and other jobs seen in Fig. 6 is conspicuously displayed in Charlie's shop, but safely out of the way on wall racks.

And speaking of keeping things out of the way yet safe, Charlie has his small lathe (Fig. 7) right out in the shop, but a steel drawer under the lathe keeps all the small parts safe from "souvenir hunters."

There is a wide difference of opinion among shop owners (and 10c store managers) regarding the honesty of the general public. It is probably true that there are people who cannot resist taking a thing of no value whatever to them for the sole purpose of taking something. The operators of novelty stores try to meet this problem by laying sheets of plate glass over certain types of merchandise. Obviously everyone was honest once, but some have gotten over it. Fortunately the display value of good shop equipment is great enough to offset the possible pilfering of small parts, and experience indicates that there is relatively little trouble from parts "walking off" in the well-managed shop.

It is true that where the owner or manager fails to note kids playing around, and to take suitable steps, that things do go astray. This writer, for example, at one time started to

(*Continued on following page*)

Fig. 4. All signs are kept clear of the driveway so as to eliminate the hazard of damage to signs as well as to cars.

Fig. 5. Plenty of width in the working stalls permits bulky equipment to be brought to the job where needed.

Fig. 6. Precision and specialized equipment is kept neatly stored in racks so that it is readily available.

1-Stop Service . . . CONTINUED

do a small welding job only to find that the regulator screws were no where to be found. Disgusting? Yes; but it's just one of the hazards of being a human being and associating with other human beings.

So while it is poor business to invite trouble, it is worse business to try to hide everything that you have. And Charlie's experience has been that good equipment well displayed is a business builder which well justifies his confidence in human nature. At the same time he does a good job of keeping his eyes open.

A fine example of Charlie's confidence in his men as well as in his

Fig. 7. This lathe is conveniently placed between the work stalls with items needed for its operation safely stored in a steel drawer of the bench.

Fig. 8. To the right and left of this busy parts washing machine are handy supplies of those often needed cotter pins, nuts, bolts and washers.

Fig. 9. A neat stock of basic accessories, spotlessly clean on well-painted shelves, appeal to all customers—especially the ladies.

customers is seen in Fig. 8. Here the orderly steel parts drawers right out in the shop make handy such things as cotter pins, bolts, nuts, washers, and what not, as well as an impressive stock of other small parts frequently needed on repair jobs.

Many shop operators have found through long experience that the time saved by having supplies handy to the mechanic well justifies any slight loss of these parts that "walk away."

While miscellaneous supplies used on jobs are becoming increasingly expensive, so also is labor. Consequently it is considered by many to be far better to use the "help yourself system" rather than to keep everything under lock and key, or under the eye of a parts man.

Of course there are shops of such size that a parts man, or in fact several parts men, may be needed to keep stock available and to maintain proper cost records. But in the smaller shops, that is, the shop employing anywhere from 3 to 7 mechanics (though that is not intended to be an exact definition of a small shop) the "help yourself system" seems to do rather well.

NOMINAL CHARGE GOOD BUSINESS

At the same time it is important from the business angle to make a nominal charge for miscellaneous supplies used on a job. We know of one particularly successful shop manager who long ago established the idea of a general charge for supplies that included things like tape, shellac gasket cement, cotter pins, safety wire, lock washers—all items so trifling as to defy accurate charging, but which in the aggregate were a considerable expense. Certainly the shop was entitled to payment for the use of such material, and few customers made any objection. So by charging each job a nominal amount, these parts became profit items instead of a drain on shop profits.

While Charlie leans strongly toward an efficient, clean shop with excellent service equipment, he does not overlook the sale of accessories. His accessories (Fig. 9) which range from upper cylinder lubricators to jeweled bolts for license plates are attractively displayed on spotlessly clean shelves in his general office to which all have free access.

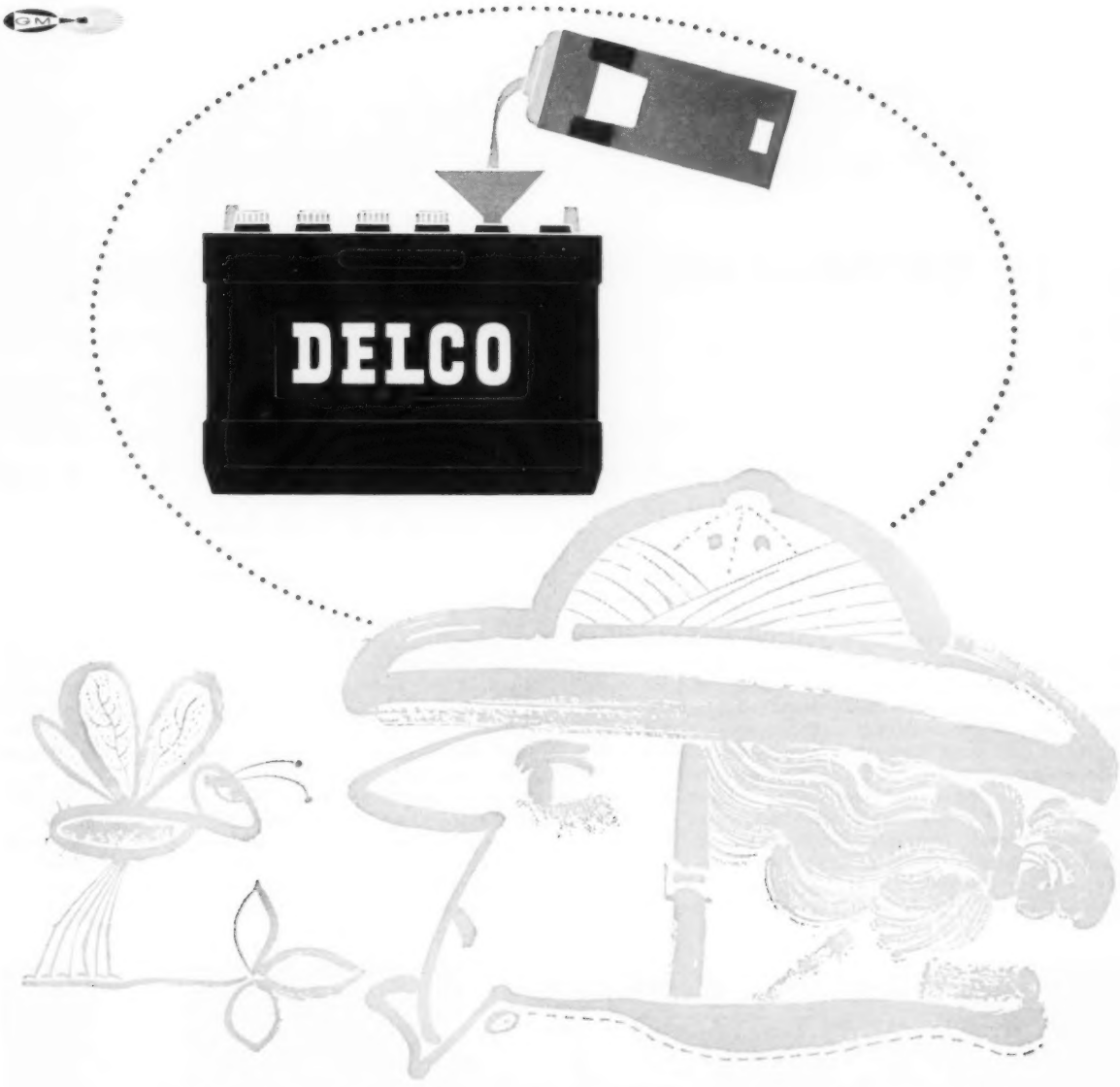
Each day Charlie's shop proves the value of arrangements that speed service — service customers *in* — and service jobs *out*.

Manifold Torque Specs Revised by Chevrolet

To minimize the possibility of exhaust manifold cracking on Chevrolet six-cylinder engines, the factory recommends that the two manifold attaching bolts nearest the carburetor be torqued to 25-30 ft. lbs.; the other four to 15-20 ft. lbs.

Using these new torque specs is said to permit the exhaust manifold to more readily adjust itself on the attaching bolts as it expands and contracts with temperature change.

"Well, yes, I *could* use a good mechanic."



WOMEN EXPLORERS

want Delco DC batteries. That's why they're easier to sell

And women explorers aren't alone in this preference. In fact, the surveys of three different national magazines proved that all America names Delco as its No. 1 battery preference. It figures. Delco Dry Charge batteries offer the freshest power money can buy and they are backed by General Motors warranties that are good all over the United States and Canada, too. That isn't all. Delco supports your sales efforts with the strongest advertising in the battery business—full page ads in Life, Look, Post, and Reader's Digest—plus the Lowell Thomas Newscast on radio. Even if your customers aren't explorers, they'll seek out the dealer who handles Delco. Like we said before: It's easier to *sell* Delco DC, because more people *know* Delco DC.

Quality built by Delco-Remy distributed nationally through

GM U-M-S PARTS SALES
UNITED MOTORS SYSTEM

General Motors leads the way—Starting with Delco Batteries

Accenting the trade in training

Modern dealer and independent service shops badly need men with the "tech know-how" to use precise, versatile equipment and instruments on today's complex cars. Where will those with a natural "knack" get the broad, intensive training to translate aptitude into valuable, specialized industrial skill?

By G. A. WHITTINGTON
Managing Editor

• WHO'S MINDING THE STORE? is a fair question anytime; and there's at least one school that will give you a quick answer if you're talking about the automotive industry's store of highly-skilled service manpower.

U. S. Trade Schools of Kansas City, Mo., makes a single-minded mission of teaching the automotive service trade to young men (and interested older ones, too) who have the ambition and the talent required. The fact is, the staff of this widely-respected institution treats all visitors —local or not—as if they are "from Missouri" and want to be shown! Here are a few of their "for instances":

Claimant to the title, "largest all-automotive resident school," U.S.T.S. maintains a student body of about 500 the year around. Its three constituent schools are devoted exclusively to the basic crafts of the automotive service field: Auto Mechanics; Body-Fender Repair and Painting, and Diesel Mechanics. For the past several years—since emerging from the status of a veteran training school and broadening into a specialized educational center for general students—it has expanded steadily. Much of the revenue, which is tuition only, has been "plowed back" into up-to-date equipment, facilities and staff.

President Illeane D. Littrell puts it this way: "Instead of making big profits, we buy equipment to train on... and we spend money in promoting good public relations with dealers, independents and factories, for placement. We stay in the automotive industry, and our placement department works only with those in the automotive field —which is where the biggest need is, nationwide, anyway. Our entire staff knows that we will always do well as a

school, if our graduates do a good job in the shops."

Carrying this positive approach into action involves "sticking to its own knitting" in many ways—which shows up in all school activities. As a striking example, the beginning student finds in the Handbook he is issued, a 13-point creed—which is designed to prepare him for a career as a good employe, as well as a good technician. Point-by-point, the Creed emphasizes the role and weight of grades, attendance, dependability, personal relations, etc.—and winds up with the question, "Would you be willing to hire a mechanic whose answers are the same as yours?"

FOCUS ON THE PRACTICAL

More training per dollar for every student, is another U.S.T.S. objective. So the student gets "live" work, as soon and as much as possible... and his class and shop instruction alike are confined to know-what and know-how he can use in the shop.

Students are drawn primarily from the five-state area surrounding the school: Arkansas, Iowa, Kansas, Missouri and Nebraska. As Miss Littrell points out, most of them return after graduation, to their home areas to use the skills they've learned—and an impressive number, more than 60%, go into the service field.

Graduates go out armed with a Diploma of course... and it's one with an unusual, "built-in" job reference appeal. There's a particular employer-directed feature to the U.S.T.S. Diploma... which every student is aware of throughout his course.

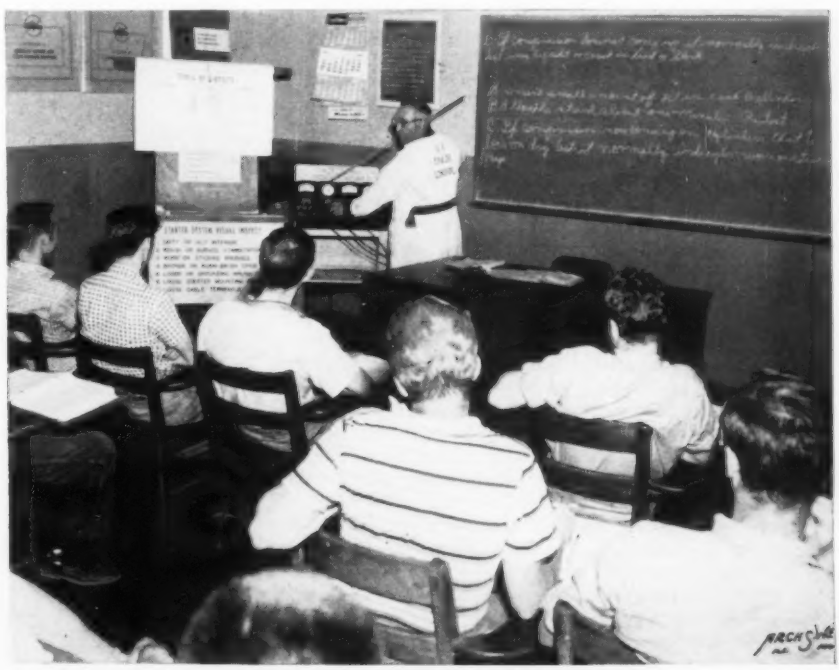
The school maintains an active working relationship with public schools in its 5-state area, and is often represented at Career and College Day activities. It is a member of the American Vocational Association, Missouri Vocational Association, Automotive Trades Association, National Rehabilitation Association, the Better Business Bureau, and the city and state Chamber of Commerce groups.

U. S. Trade Schools is approved by the Missouri Department of Education for Veterans and Adult Education; The U. S. Air Force; Corps of Engineers, U. S. Army, and the Vocational Rehabilitation divisions of the Department of Education in each of the five states. The school of Auto Mechanics is approved for a maximum 250 students per shift; Auto Diesel for 125 per shift; Auto Body for 100 students per shift.

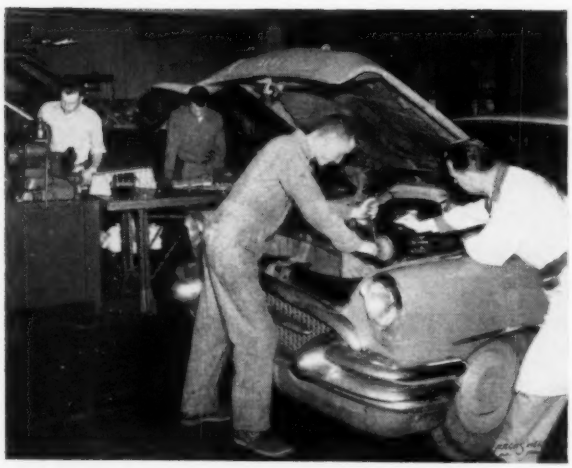
Student adjusts valves on customer car, a typical assignment. School-owned equipment, available floor space and large student body, permit U.S.T.S. to schedule a great deal of "live" work.

Admission requirements are realistic: they are relatively low on the formal education side, but very exacting on the score of aptitude and potential ability. You can enroll for Auto Mechanics if you're physically up to the work and have graduated eighth grade or have the equivalent in credits. BUT, you must also "stack up" sufficiently on the Occupational Interest Inventory of the

(Continued on following page)



Students of Auto Mechanics spend a large portion of their time on practical work, supervised by the instructor, under typical service shop conditions (left). In classroom, as at right, they get the basic theories needed to master the trade, along with a great deal of discussion of shop performance, exams, quizzes.



Power steering on a late-model car is repaired under the watchful eye of Training Director William Lancaster. Power brakes, air suspension, power steering, are all included in the Auto Mechanics course, which is constantly revised, kept up-to-date.

Mechanic Training . . . CONTINUED

California Test Bureau, and demonstrate aptitude, comprehension and personal qualities in an interview with the faculty. Body-Fender Repair and Painting requirements are lower scholastically; yet applications must pass the Minnesota Assembly Test, a Comprehension test, and interview screening.

To be admitted to Auto Diesel Mechanics, one must have completed a course in Auto Mechanics (from any recognized or approved school), or have two years experience as an auto mechanic... failing that, however, an applicant can qualify for admission by successfully taking the U.S.T.S. Automotive Diesel Engines Diagnostic exam.

Above all, the faculty stresses to all those it contacts ...these requirements are minimum. Youngsters still in high school are told, strongly, that they will have a far brighter future in automotive servicing if they graduate high school before entering the specialized training center.

TIME AND COSTS

Once accepted, a student can start his work in Auto Mechanics, or in Body-Fender Repair and Painting on any Monday. Those who sign up for Diesel face a short wait, since classes are started only every few weeks; whereas the other two specialties provide for absorbing new students continually.

Ahead of the new Auto Mechanics student are 170 school days before he can win the coveted Diploma. He will be in school six hours a day, five days a week; accumulate 1020 hours of instruction. Before he can graduate from U. S. Trade Schools as employable, the mechanic to be must **complete** this schedule! All absences, missed assignments—even tardies—must be made up before a Diploma is granted. There are no exceptions... in fact, those who exceed 36 hours combined lost time for any reason, have their studies "interrupted" until there is satisfactory evidence that the situation will be corrected, the record improved.

Thorough training, adequate preparation—in all respects—for a career as a skilled craftsman, is the aim behind this policy. The same applies to the other rules with which students must comply to remain in the school. All are required to "conduct themselves as gentlemen" in every way and at all times while on the school premises ...or elsewhere while students. Refusal or failure to maintain what might be called, "sensible good business conduct," is reason for interruption of studies, suspension or expulsion.

Beginning students in Auto Diesel are faced with an instruction program of 967.5 hours, spread over 215 school days (4.5 hours a day, 5 days a week). At that pace, he can earn his diploma in 43 weeks. The Body and Fender specialist-to-be receives 765 instruction hours, in 170 school days that add up to 34 weeks. In his case, the schedule is also 4.5 hours a day, and the same 5-day week.

TUITION ON EASY TERMS

Carrying emphasis on the practical into the money matters necessarily involved in getting a good training, U. S. Trade Schools offers the students a choice of the method and rate of payment. There's cash in advance, at the lowest total amount; or time payment plans. For Auto Mechanics, total cost is $490 on a cash in advance basis. Plan 2 calls for $41.00 down (including the registration fee), $13.50 a week for 34 weeks... raising the total cost to $500.00; and Plan 3, totalling $554 is $10.00 registration fee down, $16.00 weekly for the 34 week course.

Diesel Mechanics costs $550 on the Plan 1, cash arrangement; $560 under Plan 2, which includes $44.00 down payment and registration fee, and $12.00 a week for 43 weeks. Plan 3 is $14.00 a week for 43 weeks after the $10.00 registration fee; and total cost of $612. Body-Fender Repair and Painting comes to a $450 lump payment; and has an alternate plan, $42.00 down, and 34 weekly payments of $12.00.

Those students who demonstrate financial responsibility by either paying cash, or using Plan 2; and then meet all study requirements, are rewarded upon graduation with a gift, a set of tools valued at approximately $50.00.

According to Miss Littrell, the plans make it possible for virtually any interested man to obtain an education in automotive trades. Eighty-five per cent of the students work—earning their way—as they go through school. This is one reason why all three of the schools offer either day or night shifts. Auto Mechanics classes are from 7:45 am until 2:00 pm, or 6:15 pm 'till 12:30 am. Auto Diesel's 4.5-hour daily sessions run 7:45 am—12:15 pm, and 6:15—10.45 pm; while Body-Fender sessions are either 8:00 am —12:30 pm, or 6:15—10.45 pm.

The remaining free time, whichever shift the student attends, has proved sufficient to earn the income required and yet devote an adequate part of each day to studies

Latest equipment and practices are featured in the Body-Fender shop, which was established in mid-1956. The students do all types of body work on customer cars—up to complete rebuilding.

Overhauling a Cummins in the Auto Diesel shop. Students tackle live jobs on buses, trucks, wheel and crawler tractors, graders; have tools and instructions to go as far as complete rebuilding.

and relaxation. U.S.T.S.'s Placement Department, with its automotive field contacts, is usually able to line-up good part-time jobs. While of course, the Placement Department cannot guarantee employment to students... its record speaks pretty clearly of success in these efforts.

Local housing is also usually obtained through the efforts of the school, which has developed an Approved List as well as numerous contacts. Rates vary according to the requirements of the roomer, the "extras" desired, whether renting alone, etc. However, the costs are quite nominal, and within the earning power of the trainees. Another favorable factor is the central location of U. S. Trade Schools, which is within walking distance of business, social and recreation centers, thus saving in transportation time and expense.

PROGRAM FOR PROGRESS

Here's what the Auto Mechanic trainee looks forward to as he trains his sights on his chosen trade—out of the 1,020 hours of instruction, he'll spend 306 (or 30%) on theory and fundamentals, review and test, and discussion of shop work... all in the class room. A like number of hours will be devoted to practical shop practice, learning and practicing the manual operations that make up the foundation of a successful trade career.

His remaining 408 hours—40% of the course content—will be spent in "live" work. He'll be under the guidance and supervision of an instructor, true; but in all other respects, his working environment will be that of the typical dealer or independent service shop.

To "tear down" the Auto Mechanics course formally, the Student's Handbook presents the specs in this manner: Part I, Introduction, tools, welding... 48 hours; Part II, 240 hours on power plant, lubricating system, cooling system and fuel system; Part III, on clutches, transmissions (automatic types are featured), propeller shaft and final drive... 240 hours; 158 hours on chassis, frames, springs, etc., front axles and suspension, steering gear, wheels and brakes, making up Part IV; in Part V, 166 hours devoted to battery and ignition, starter and generator, lighting circuits and electrical systems in general, and for Part VI, 168 hours in engine testing and servicing at the advanced level.

Throughout the learning cycles, the student will take a written exam at least once a week... with that score only one basis for his weekly grade. Attendance, conduct, aptitude, attitude, and class work as well as shop work, also count. In addition, the instructors can—and do—toss in unannounced quizzes at any time; and the student who is really learning his trade, can be expected to do right well in these, too. Once a month, grade cards are issued. Trainees are encouraged to consult with their instructors and counselors on any problems they find... and the frequent tests and scores provide an ideal "reading" on both the need and the results.

Students of Auto Body-Fender devote one-quarter of the course, or approximately 191 hours, to theory and fundamentals, discussion of shop work, review and tests in the classroom; the same percentage in practical shop work, preparing for actual servicing of customer cars... and the remaining half of their 765 total hours in live shop work. Those who've been admitted to Automotive Diesel spend 60% of the school time in the shop... that's more than 580 hours; and the remaining 40% on the classroom front.

TURNING THE LEARNING TRICK

Specs for Body-Fender Repair and Painting are as impressive as employers would (and do) want. Here the formal Handbook breakdown lists a Part I, 22½ hours of orientation, construction principles, shop safety; moving on in Part II with 45 hours of welding, brazing, tinning, leading; followed by 112½ tough hours of shop practice in fundamentals of metal work, which make up Part III.

In Part IV, the Body-Fender student spends 45 hours on minor top repair, upholstery, quarter panels and trim, and glass; and he follows, in Part V, with 67½ hours spent on radiators, grille assemblies, body wiring, front suspensions and frames, before going on into major repairs, 180 hours of them, in Part VI. Now well along, the trainee moves into sanding, surfacing, color mixing, paint-

(Continued on following page)

Mechanic Training . . . CONTINUED

ing and polishing, which are given the 202½ hours included in Part VII. His final 90 hours, in Part VIII, provide him with more practice in painting, drill good shop practice into his store of job information; also cover customer service, cost estimating and shop management.

Automotive Diesel breaks down into 11 parts, starting with 22½ hours on history of the diesel, tools and equipment and the same number on the theory of diesel engines, in Part I & II, respectively. Part III provides 67½ hours on transmissions, power drives, rear axles, truck and truck-tractor types; Part IV, 90 on fundamentals of diesel engine mechanical operations; Part V another 90-hour section, electrical and ignition systems. Next follow 22½ hours each on diesel air and cooling systems; 45 on lubricating systems . . . in Parts VI through VIII; and 247½ on diesel fuel systems, Part IX.

At this point, the student goes into Part X's 292½ hours of live diesel engine troubleshooting and tune-up. He then winds up the training with 45 hours on the conversion and maintenance of L.P. gas engines.

CONCENTRATION WITHOUT CONGESTION

While the U.S.T.S. student is deliberately kept up-to-his-neck in work, he's still given plenty of elbow room for learning. In the first place, he does not lack for the indispensable personal attention as he tackles his assignments: This is assured by maintaining an average instructor load of 16 students. Some of the instructors have as few as 5 students, at times; and never is any one of them permitted to have more than 25.

Certainly the instructor is the key to trade training that produces an employable graduate. To see that the student gets "his dollar's worth" in this respect, U. S. Trade Schools picks its teachers carefully, and works them hard at the job of keeping abreast of the industry and its demands. The typical U.S.T.S. instructor has seven years shop, five years teaching experience. As one of the 21 full-time instructors, he meets every month with the full administrative and teaching staff, discussing all phases of the trade training job. He is regularly "on the go" to take in factory schools—examples, General Motors, Ford, Chrysler, Acme Paint—or attend special classes on advanced technical developments or training methods.

In his bag of teaching tools, he has the U.S.T.S. standardized course of study for his subject . . . detailed down to day-by-day . . . to focus his own store of data for the student's maximum utilization. He also uses the most up-to-date training aids in charts, films, cutaway models, from all leading manufacturers. One of the first things the U.S.T.S. teacher does is to encourage his students to begin building their own personal files of manufacturers' literature . . . and to use this data regularly when the occasion arises.

Although many of the trainees purchase their own textbooks, this is not required. All supplies, including tools, which are checked-out as needed, are furnished. Nor are there special lab fees, service charges, rentals or deposits. Students pay the registration and tuition fee as their only cash outlay . . . and, provided the studies are satisfactorily concluded and all the financial obligations met, can come away with a full set of tools, as mentioned previously.

Incidentally, the U.S.T.S. faculty is well aware of what makes Jack a dull boy, and encourages student recreational activities of many types in conjunction with the short-hours instruction day. The school's official colors are represented in local basketball; and there's quite a bit of vigor expended in such intramural sports as swimming, tennis and bowling. For the use of its student body, U.S.T.S. holds 50 memberships in the nearby "Y."

PHYSICAL FACILITIES

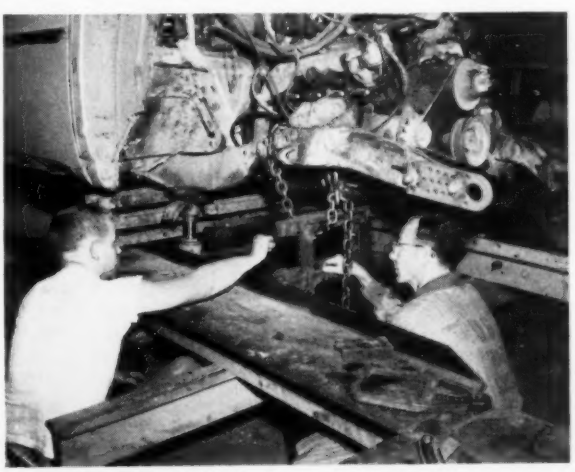
In "plowing back" profits into the physical plant, U.S.T.S. has built an impressive service establishment, representing an investment of hundreds of thousands of dollars. For example, the Auto Mechanics schools occupies two floors in an all-brick building; has 10 classrooms, averaging 360 square feet, film rooms equipped for showing 16 or 35 mm film, or slides, and special training areas stocked with lab equipment, major automobile power plants, systems and components.

Auto Mechanics has enough hand tools in its crib for 250 students per shift, as well as an adequate supply of special tools for specific automotive units. It has an allowable floor load of nearly 70 cars on each of its two floors; has 2,000 square feet of live work area on one floor, 7,500 on the other. Customer jobs average about 175 per month.

In the live job category, Body-Fender has 10,000 square feet of working area, out of its total of 14,500; while Auto Diesel has just under 1,000. Both these schools

(Continued on page 64)

Although the school does not compete for business with local shops, its students handle hundreds of service jobs each year as live assignments. About 75 cars per month come into Auto Mechanics for work ranging from tune-up to overhaul; above, one student is learning to balance a tire on the car. Below, a frame straightening operation in the Body-Fender shop.



THE CITY THAT DIDN'T EXIST A MONTH AGO

Every 30 days the U. S. adds as many new Americans as live in Norfolk, Va.—creating brand-new wants and needs which must be satisfied.

What does this mean to you? It means greater opportunities than ever before—in all fields. Home construction is expected to double by 1975. Power companies plan to increase output 250% in the next 20 years to provide the power for scores of new labor-saving devices. Clothing suppliers predict a one-third increase in 7 years.

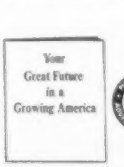
With 11,000 new citizen-consumers born every day, there's a new wave of opportunity coming.

7 BIG REASONS FOR CONFIDENCE IN AMERICA'S FUTURE

1. **More people** . . . Four million babies yearly. U. S. population has *doubled* in last 50 years! And our prosperity curve has always followed our population curve.
2. **More jobs** . . . Though employment in some areas has fallen off, there are *15 million* more jobs than in 1939—and there will be *22 million more* in 1975 than today.
3. **More income** . . . Family income after taxes is at an all-time high of $5300—is expected to pass $7000 by 1975.
4. **More production** . . . U. S. production *doubles* every 20 years. We will require millions more people to make, sell and distribute our products.
5. **More savings** . . . Individual savings are at highest level ever—*$340 billion*—a record amount available for spending.
6. **More research** . . . *$10 billion* spent each year will pay off in more jobs, better living, whole new industries.
7. **More needs** . . . In the next few years we will need *$500 billion* worth of schools, highways, homes, durable equipment. Meeting these needs will create new opportunities for everyone.

Add them up and you have the makings of another big upswing. Wise planners, builders and buyers will act *now* to get ready for it.

FREE! Send for this new 24-page illustrated booklet, "Your Great Future in a Growing America." Every American should know these facts. Drop a card today to: ADVERTISING COUNCIL, Box 10, Midtown Station, New York 18, N. Y.



(This space contributed as a public service by this magazine.)

By GUY F. WETZEL
Technical Editor

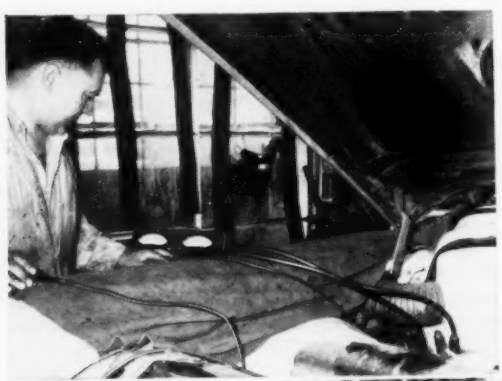
When is a tune-up a "tune-up"?

Peak performance from today's high compression engines cannot be had with a "thin dime" and guess-work . . . it takes modern test equipment, plenty of "know-how" savvy and a proven procedure of operation.

● TO MOST car owners, a "tune-up" means getting the spark plugs cleaned, installing new points and condenser and having the carburetor idle mixture and idle speed adjusted—and that is all! Unfortunately, there are still too many shopmen who look upon a tune-up in the same light.

There are shopmen, however, who take a great deal of pride in a tune-up. Many of these mechanics allow themselves from three to four hours for such a job, and are busy this full period, making all the tests and adjustments necessary to be sure each component that affects the operation and performance of the power plant is just right.

In spite of a fairly generous charge for the job, it has been our observation that most of these shops are so busy that cars are taken by appointment only; and, in some, work is frequently scheduled from two weeks to a month in advance. From this, it is apparent that there are enough car owners who appreciate and will pay for good work, to make it well worth while for service shops to render a tune-up job that is not only profitable to the shop, but more important, one that completely satisfies the customer. After all is said and done—a satisfied, happy customer is still the best advertisement a shop can have.



After testing the battery for gravity with a hydrometer, give it a capacity test by loading it up to 3 times (in amperes) the ampere-hour rating for 15 seconds and note the voltage drop.

Taking a voltage drop reading while cranking motor is operating gives a good "area test" on the starting system.

A CONSCIENTIOUS OPERATOR

It was the writer's good fortune recently to be calling on a service shop where a thorough and complete tune-up job was being performed. The operator is one of those thorough and careful workers to whom only a complete and competent job is good enough for his customers. He charges $15 for tuning a late model V-8 engine, but based on what many car owners get for their money, his job is worth $20 or more. When he takes on a tune-up, he figures on spending at least three hours on each job, and often spends more time if he feels the job needs it.

Upon looking around this shop, it was immediately apparent that here was an equipment minded mechanic —where nothing is left to guess-work. And speaking of guess-work, there is no hit-and-miss method followed in this shop—there is a definite, well-planned procedure which is followed on every tune-up job.

One important feature of following a set procedure on every job is that it can quickly be determined whether the engine is mechanically in condition to benefit from a tune-up. If it is not, then the work needed can be explained to the car owner. In all

probability, if the shop is in a position to do the work, the motorist will authorize having this work done.

In this connection, the case of a Cadillac owner's recent experience comes to mind. He took his car to a high grade tune-up man, and it soon became quite evident that valve work was needed; the engine was not in condition to permit a good tune-up job to be done.

The tune-up expert was too busy to handle the valve work, but recommended a shop where the car owner would be assured of a first-class job. A few days later the car owner was back with his car, and with the engine in good mechanical condition, the tune-up man was able to perform a job which unleashed all of the power originally built into the engine. This car owner was so pleased with the outcome that he sent several of his friends who wanted good work done on their cars, and were willing to pay for it.

If more shop operators would look at their work in this way, customer confidence in service shops, particularly car dealers' repair shops, would not be at the low ebb that it is at this time. The important point that we want to make here is that the kind of a job that will be described here is not "too fancy," and "too much work" or "too time consuming," but is simply good business.

Tune-up requires three basic conditions: (1) knowledge of the engine, fuel system, ignition system and electrical system; (2) facility in the use of test instruments, and (3) suitable testing equipment and facilities—and shopmen who are not competent in these respects should not be trying to do tune-up work.

But let's follow through on a tune-up job, as performed by our tune-up expert, Walt Zadrozny.

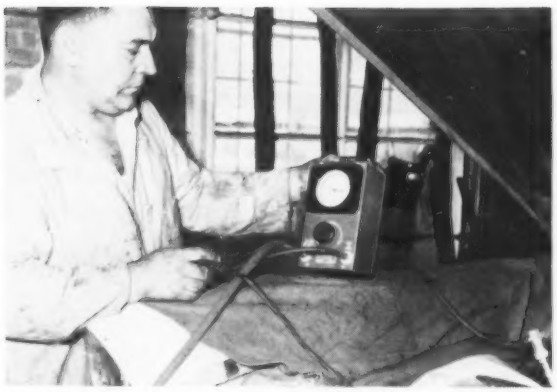
BATTERY AND STARTING SYSTEM

1. Check battery gravity. If not above 1.250 the battery should be charged. Note any differences in cell to cell gravity. If over 10 "points" (.010), the battery is probably on its way to failure.

2. Check battery capacity. Use the battery-starter tester and put the battery under a load (in amperes) of three times the ampere-hour rating, for 15 seconds. The voltage should not drop below 4.8 volts on a 6-volt system, or 9.6 volts on a 12-volt system. If it does drop below these values, either the battery is defective, or it needs charging. In either event a note should be made of the condition and called to the owner's attention.

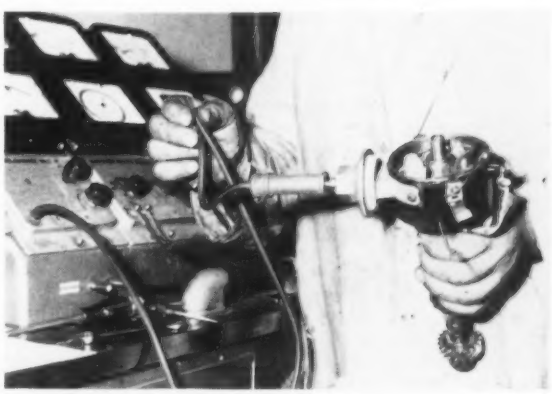
3. Disconnect cables from the bat-

(Continued on following page)



Making a cylinder leakage test is far superior to the standard compression test because it gives much more information.

Removing the distributor may seem like a big job to some mechanics, but it isn't very difficult—and it is the only way it can be accurately checked.



A quick but valuable test is to connect the vacuum unit, take a reading, then pinch the tube to see if there is any variation in the reading. If there is, the vacuum unit is leaking and should be replaced.

With the distributor on the test machine, dwell, dwell variation and both vacuum and automatic advance can be checked against specification.

Making the ignition efficiency test by touching the negative voltmeter lead to each spark plug in turn and noting meter reading. This also checks the secondary polarity, which should be negative regardless of battery polarity.

Tune-Up . . . CONTINUED

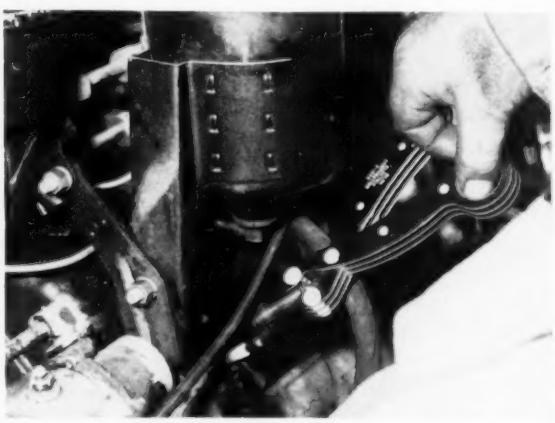
tery, clean, reconnect and tighten. If cables are in bad condition, make a note of it and recommend replacement.

4. With the voltmeter, check the voltage drop in the insulated side of the starting circuit, by making contact with the voltmeter leads to the insulated battery post and the starting motor connection, with the motor turning over the engine. Do the same with the grounded side by contacting the grounded battery terminal and the motor frame. Voltage drop should not be over .2 volt.

5. Check battery voltage drop while the cranking motor is running, which should not be below 5.0 volts or 10.0 volts, for 6-volt and 12-volt systems, respectively. If the motor turns the engine over at normal speed with only normal voltage drop, we can assume that the battery and starting system are in satisfactory condition.

CYLINDER COMPRESSION

1. With the engine warmed up to normal operating temperature, the spark plugs are removed. The next step, as Walt does it, is to check each cylinder with the cylinder leakage tester. In the absence of a cylinder leakage tester, the standard compression tester can be used, but so much more information can be obtained by using the cylinder leakage tester that its use is well worth while. It is true that it takes fifteen to twenty minutes longer to use the cylinder leakage tester on a late model V-8 engine, but Walt's experience indicates that enough valve and ring work is turned up by its use to make it profitable to spend the additional time. The value of the cylinder leakage test lies in the fact that it will pin-point the compression leakage path or paths; whether past the rings, the intake valve, the exhaust valve, or a defective head gasket.



Ignition output test is made by pulling each spark plug off in turn with a pair of insulated pliers. Meter reading indicates condition of system.

Contrary to the belief of many service men, the cylinder leakage tester is really simple to use, and furthermore, it can be demonstrated to the customer so there will be no doubt in his mind about the need for cylinder or valve work.

IGNITION SYSTEM

1. After cylinders have been checked, the plugs are inspected for condition. If they have not gone over 5,000 to 6,000 miles and appear to be in good condition, they can be cleaned, have the center electrode end filed flat and square, and be correctly gapped for further use. If they appear to be of the wrong heat range or in questionable condition, new ones should be put in.

2. Remove distributor from the engine and inspect the breaker points. If they show wear or transfer of metal from point to point, they should be replaced.

3. Before putting the distributor on the distributorscope, make a quick test of the vacuum advance unit. Connect the unit to the vacuum line on the distributor tester and note the reading. Then kink the hose so it will shut off the vacuum unit. If there is any change in the reading (increase) it shows that the vacuum unit leaks and should be replaced.

4. Put the distributor on the tester, and set the dwell. Check the dwell variation, which should not be over 3°—except on some of the Auto-Lite distributors which have a built-in variation of up to 7° as the vacuum advance operates. The automatic advance and vacuum advance should be checked against specifications and any needed corrections made.

In far too many shops, even where a distributor tester is available, the distributor is not removed because it is too much work, though authorities on tune-up all agree that the only way a distributor can be thoroughly checked and properly adjusted is off the car.

5. Reinstall distributor on engine. Make a visual check of all high tension cables and terminals. Be sure that all cable ends are pushed all the way down into the distributor cap towers.

6. Check ignition timing with timing light and adjust as necessary.

7. Check ignition efficiency and polarity. This is done by having an extension on each spark plug, and then touching the **negative** lead from the meter to each spark plug in turn, with the **positive** instrument lead grounded. The meter should read upscale and the readings should be close together for each cylinder. This test reflects the resistance of each secondary circuit. If resistor cables are used, the resistance will vary with the length of the cable and there will be some difference between the longer and shorter cables. Polarity should be negative.

8. Check ignition output on the meter designed for this test. The test is made by pulling each spark plug wire off in turn with special insulated pliers. This loads up the ignition system to its maximum and indicates on the meter whether the system is in good condition or whether there are defects which could cause ignition

failure or unsatisfactory operation. This test only takes two or three minutes but will reveal defects that would otherwise be hard to find.

If an oscilloscope is available the ignition efficiency and ignition output tests can be eliminated, since the oscilloscope will indicate defects in the ignition system.

9. The resistance of the primary circuit is checked by turning on the ignition current, with breaker points closed, and touching one voltmeter lead to the battery side of the ignition coil on 6-volt systems, or the battery side of the ballast series resistor on 12-volt systems, and to the insulated battery terminal. This will check the resistance of ignition primary connections and the ignition switch, and should not be more than .1 volt. Also check resistance from the distributor side of the coil to ground, which also should not be over .1 volt, with points closed.

GENERATING SYSTEM

1. The important test in this system is the generator voltage as controlled by the voltage regulator. This test is made with the volts-amperes tester by connecting the voltmeter to the "A" terminal and to ground. The voltage, in general, with a fully charged battery, or with a ¼ ohm resistor cut into the circuit, will be 7.4 volts for a 6-volt system or 14.8 volts for a 12-volt system. If there is any appreciable variation from these values, unless there are special conditions to be considered, the voltage regulator should be adjusted.

2. The ammeter should be cut into the circuit in series, connecting it to the "A" terminal on the regulator and the end of the wire which was disconnected from the "A" terminal. The ampere output should be in accordance with specifications.

Unfortunately the generating system is ignored by many tune-up men, but its satisfactory operation is quite important to the operation of the car and its testing should be included in every complete tune-up.

Caution: On cars equipped with the Delco-Remy double contact voltage regulator, never test for generator output or operation by grounding the field, unless the field wire from generator to voltage regulator is disconnected. Disregard of this caution may lead to burning out the generator system wiring when the lower points on the voltage regulator are working.

FUEL SYSTEM

1. The important tests on fuel system components are for volume of fuel delivered and fuel pump pressure. New equipment, recently introduced, makes it quick, easy and convenient to make these tests. If either the volume of fuel delivery or pump pressure are not at or above the specified minimum, the power plant performance will not be satisfactory. The volume of fuel which the pump should supply is 1 pint in 30 seconds. If the pressure is up where it should be, but the volume is below the specified amount, it indicates air leaks or restriction in the suction line from tank to pump, which must be corrected. If the pressure is below standard, the pump spring is weak, the linkage may be worn, or the pump diaphragm is in poor condition and leaking. This would indicate that the pump must either be rebuilt or replaced.

2. The automatic choke should be carefully checked for free action, for full closing and full opening. On some of the cars using Holly carburetors there is a specially formed tube which carries the hot gases to the automatic choke to open it when the proper temperature is reached. Sometimes this tube is ruptured, which is indicated by excessive carbon deposits in the choke spring chamber. This requires removal of the manifold and replacement of the tube.

On some of the 1955 and 1956 Oldsmobiles and Pontiacs, a solid paper filter disc is placed at the top of the cylindrical gas filter. This disc can easily become plugged up, restricting the gas flow, or even shutting off the flow. Replacement gaskets, with four large holes in the disc, are available, which eliminate any restriction to fuel flow. These should be used wherever a solid one is found.

3. The fast idle should be checked, and adjusted if necessary to give correct action. Finally the idle mixture screw or screws should be adjusted, and then the idle speed stop-screw should be set to give the correct idle engine speed.

4. The heat riser valve should be checked for free action. If stuck in either the open or closed position the fuel economy and engine action will not be satisfactory.

5. The air cleaner should be inspected. If of the oil bath type, the filter element should be thoroughly washed, the oil replaced if dirty, and brought up to the correct level. If of the dry type, the filter element should be cleaned if in fairly good condition; otherwise it should be replaced.

6. If the carburetor appears to be

(Continued on page 42)

An important test which is frequently neglected is the checking of generator voltage and amperes output. The instrument shown has a resistance unit which can be inserted in the circuit to offset battery charge that is lower than full charge.

Using the latest equipment to measure both fuel delivery and fuel pressure. This is an important test, since regardless of condition of all other units, the engine will not run right if it does not have an adequate supply of fuel at the right pressure.

"So you want to open a service shop?"

It's like leaving home to "go on your own" the first time. Here's "boot training" for the ex-salaried-employe embarking on the tossing seas of independent enterprise.

Part V—Merchandising

By HERB CARRIER, Detroit Editor
and
DR. GEORGE A. FIELD, Wayne State University

• THE ULTIMATE SUCCESS of an independent repair shop hinges heavily on two prime factors: (1) The ability to do quality repair work, quickly and at a reasonable price, and (2) the ability to merchandise.

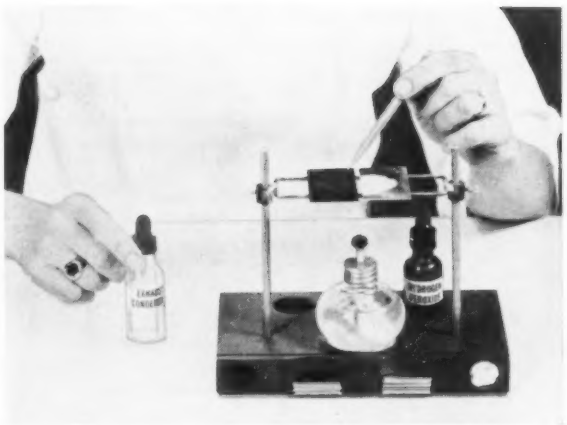
Let's assume that mechanical ability is already present in sufficient quantity. Certainly it must be, else all other discussion is null and void. It is illogical to assume that a man would consider going into business in a mechanical field *unless* he was a qualified mechanic. Let us, therefore, limit our discussion to merchandising, with its facets of display, promotion, advertising, and publicity.

ATTITUDE

One prime requisite of a good merchandiser is a clearly visible sales personality. Heretofore, you may have considered yourself to be one of the world's best mechanics. That's fine. Now, in addition to taking bows for being a mechanical marvel (and you should take bows, for a good mechanic is a highly skilled individual), you must build up confidence in yourself as being a super-salesman. This means, of course, that you must look, talk, act, *and think* as a salesman. You may have to really work at it, but it's absolutely vital that you become sales-minded.

Becoming sales-minded means more than establishing a strong desire on your part for people to buy your goods and services. This is elementary logic—the more you sell, the more you make. It only follows that you want to break all existing sales records. However, you must instill enthusiasm and the desire-to-buy in your potential customer. Make him *want* to buy from *you*. Give him reasons. Show him why. Make it easy for him. Always sell. Always push sales, and always promote sales.

Take many a merchandising tip from methods of manufacturers who'll be selling you! This Fram Corporation lab-on-wheels is a rich salesmanship suggestion.



Dramatic demonstration is universally accepted as one of the most telling of selling tools. Here's an example you can profit from: Pratt Muffler Division's accelerated wear test kit, used to prove the acid resistance of an alloy-coated muffler steel.

Along with sales thinking must go sales knowledge. People buy at certain places and from certain people for very concrete reasons. It's true that sometimes you'll score on the "impulse" buyer—one who buys erratically with no apparent reason—but you can't depend upon this kind of buyer for steady business.

Your sales platform must be built of proven sales planks. These planks, and how to apply them, you'll have to learn. One of the best sources of such knowledge is people who are already successfully in business. The jobber from whom you'll be buying parts will be applying merchandising techniques on you. Analyze critically your dealings with jobbers, to find out just why you enjoy doing business with certain of them, and are not particularly happy about dealing with others.

Do you have a favorite barber shop, or cigar store? Why? It's important to find out why you, as a customer, respond in a definite manner. An understanding of exactly why you buy where and what you do, will serve as an excellent guide when you begin to operate as a merchandiser.

It's also a good plan not to stop with an analysis of your own personal likes and dislikes. Visit stores for the sole purpose of watching how customers are handled. See how the true merchandiser goes along with the tide. Notice how he quickly changes his own personality to harmonize with the many, many personality types upon whom he depends for a living.

Then, for a real revelation, watch the merchandiser deal with a vender! See him do a Jekyll-and-Hyde routine right before your eyes. Watch him as he becomes the customer and demands service—with a capital "S"—from those who list him as their customer. A merchandiser who is aggressively alert can change his manner as easily as he can change his shirt.

KNOWLEDGE VIA READING

There are other good sources of information on the art of profitable merchandising. Practically all human knowledge has been written down somewhere. A visit to the local library can lead the way to several books on the subject. It's important to get more than one book on the same general subject. For one thing, it will give you more than one viewpoint. For another thing, some books are easier to read than others. By reading the works of several authors, you can gain a working knowledge of any one subject in a minimum amount of time.

Don't be too hesitant about spending a part of your valuable time reading pertinent text books. A daily reading period can be a valuable habit if the material read is keyed to your business. In fact, most successful businessmen are avid readers. Some spend several hours a day reading. It's entirely possible that the hours you spend reading trade literature will eventually be accepted as an entry on the credit side of your daily ledger.

DISPLAY

Maybe it's true that you can't judge a book by its cover, but have you noticed the covers on the books for sale in the local drugstores? An attractive, well designed cover is part of the book publisher's merchandising plan. He knows that covers are important; that proper display is important to the sale of practically all goods and services. An excellent example of this is the perfume business. It is said that perfume containers actually cost more than the perfume itself.

In the automotive repair business, display is also important. If you have located wisely, the interior and exterior of your place of business is clean and attractive. This is good—but it's not enough! Undoubtedly, you have an adequate sign to tell the world you are ready and willing to trade your mechanical skill for money. A good sign of this sort is a must; but, again, it's not enough. You need displays.

One of the better techniques of service shop display is the dramatized poster. For example, a poster reading, "Let Us Fix Your Brakes," is better than nothing, but it's not really good. A sign saying, "Good Brakes Can Save Your Life," is better, but still needs improvement. Perhaps the best brake display would be a poster which reads, "Do Your Brake Linings Look Like This?" Below the sign would be a sample of badly worn linings. In conjunction with this you would have a sample of new brake linings and a poster saying, "Be Safe—Let Us Fix Your Brakes Now—Only $——."

The successful display is not necessarily the clever or cute one that amuses. It is the one that makes the customer *want* to buy—and want to buy right now from you! The customer must want your goods or services more than he wants his money. Common reasons for this spending motivation are the desire for safety, pleasure, or personal gratification.

Another area to which buying appeals are successfully made is the money saving realm. For instance, a display of dirty spark plugs alongside a clean, new spark plug could nicely be accompanied by a poster reading, "Stop Wasting Gas—New Plugs Can Save You money. Let Us Change Your Plugs Today—Only $——."

BE ORDERLY

Luckily, the before and after samples to accompany persuasive posters can be made up in your own shop. They should be neatly mounted on freshly painted plywood or other suitable material. However, the actual sign should be done by a professional.

Scout around to find a free-lance sign painter. Explain to him what you want. Then, talk a deal. Don't be afraid to suggest the you-scratch-my-back-and-I'll-scratch-yours routine. As a businessman he'll either have a truck or a car—maybe both. Point out the fact that you'll consider trading a little mechanical work for a little sign painting. Sometimes it works. Don't go overboard in this area though. Remember, bartering went out of style a long while ago. You couldn't exist on a swap basis, but you can indulge in "horse trading" whenever the situation calls for it.

When you have struck a deal with the sign painter,

(Continued on following page)

Manufacturers offer much merchandising aid, such as these representative curb signs. In many cases, interchangeable sales messages, to maintain attention, are provided to shops.

Opening A Shop? . . . CONTINUED

have him make up a series of posters. This is important. Posters should be **changed** regularly. People get used to things quickly. A poster displayed too long will not even be seen after a short while. A good trick is to build a poster holder that will accommodate several posters—one behind the other. Then, you can change signs quickly and easily by removing the front poster and placing it in the back. This kind of holder also affords safe storage space for posters, and prevents the unused ones from becoming damaged.

To be effective, displays should be followed up by consistent personal selling. When talking with prospects, point out your displays. Let them help you sell him on the reasons why he should buy now. High pressure isn't necessary, but concentrated sales effort is.

PROMOTION

A good merchandiser always has some promotion going—and he's pushing it hard. Many repair shops never do any promoting, and, consequently, only get a fraction of the trade they could have.

Start your promoting with a grand opening. See that the entire neighborhood knows about it and knows what kind of service your place of business offers. A grand opening with some kind of give-away will afford everyone at least one reason to visit your shop. This is how you hope to develop new habit patterns. Make your grand opening as big as possible without spending too much money. A good send off goes a long way to getting you in the right mood for success.

Other promotion ideas include advice to individuals or organized groups on souping up cars. Maybe you could sponsor an old model stock car for local competition. Bicycle tune-ups are also good promotion tricks. Nothing specialized, just an oiling or general tightening up. Promotion schemes aimed at the young people are always good. Kids grow up eventually and loyalties are established early. Look at Chevrolet in the "Soap Box Derby." This is an excellent form of promotion.

DON'T OVERLOOK THE LADIES

Women, as every merchandiser knows, hold an embarrassingly strong grip on the family purse strings. It's a fact that the fair sex spends most of the money. This is something that we, who think we wear the pants, may not be too happy about; but which as merchandisers, we can't afford to ignore. The answer is, obviously, to cater to the women and have them spend some of the money in automotive repair shops.

Some of the most successful promotions include those aimed directly at women. For instance a car know-how course especially for women may get a great play. Lots of women have their own cars, and want to know a little about them. Not deep technical details, but general maintenance information that will help them understand why they are to spend money on car upkeep. People, women particularly, want to know what they are getting for their money. The more they understand the skill necessary to repair a modern car properly, the less resistance they offer in the price department.

Some standard promotions include free pick-up and delivery, free transportation to work if the car is dropped off in the morning, and special rates on slack days, or if the car can be left longer so that it can be sandwiched in at odd moments. All these are good promotion ideas and can be worked profitably.

STUDY COMPETITION

In looking for promotion schemes, study what your competitors are doing. Then, try to improve upon their ideas. Also adapt ideas from other type businesses. A "Monday Only" sale in department stores could be carried over to the repair shops. Use imagination. Generally, it's much better to over-promote (if this is possible) than it is to operate a dull, stagnant shop. There's no reason why every day should be a life and death struggle. It's possible to have fun even though you are in business.

Make Friends—The more people you have on your side the greater will be your chance of success. Get acquainted with car dealers, competition, insurance adjustors, police, towing services, etc. They are all in a position to steer business your way.

PUBLICITY

Publicity is a trading game. You get newspaper publicity by giving the editor news that he can print. Many things about your business very likely qualify for mention. For example, your grand opening. This is a natural. Submit a couple of pictures about the opening day goings on. Kids blowing up balloons, guessing how many nuts and bolts in a fish bowl, etc. These are news items especially in small, local papers.

Make sure that your sign and building appear in any picture you submit for publicity. Editors love pictures because readers love pictures. Don't ever be accused of not sending pictures to the papers. One published shot is worth the cost of many prints that wind up in the paper's picture file.

Business cards are good publicity. Yours should tell what's good about your shop as well as your shop's location. Constantly hammer home **why** people should deal with you. Show them, tell them, make sure they know. Word of mouth is fine, but don't rely on it as your sole form of publicity.

ADVERTISING

The most common mistakes in advertising are attempts to be superficially witty, and not analyzing your selling problem. In mapping out your advertising, first determine what you have to sell, who are your prospects, what will make them buy, and how can they best be reached.

What You Have To Sell: Just what is it you wish to sell? More particularly, what are you selling that someone else doesn't sell better and cheaper? Analyze your strong points and capitalize on them in your advertising. Are you the friendliest cuss in town, or just the best mechanic in four counties? Are your rates the lowest? Are you the quickest, most dependable craftsman in the business? Do you have the best equipment?

Beware making wild claims or gross exaggerations. You'll irritate the public if you try to fool them. Honestly seek out your areas of difference, then advertise them so that people will know why it's best to come to you for their service work.

Who Are Prospects: Car owners naturally are the most obvious prospects you have, but there could be others. For example, lots of police vehicles are serviced by independent garages; so are milk trucks, bakery trucks, garbage trucks, and many, many similar units. Used car lots also can be real live prospects. Some boat yards call in mechanics for extensive inboard motor repair.

Canvas your market area. Uncover all possibilities. Then, hit them with good solid reasons why you're their man.

What Makes People Buy: People don't buy things, they buy what the things will do for them. A good cloth coat, for instance, will keep the wearer much warmer than a mink stole but what woman would choose cloth over the mink that will make her the envy of friends? The same reasoning enters into a large number of all sales. Two-tone paint doesn't protect the metal any better than paint of one color. Yet, most cars sold today are two-tone, and usually at an extra charge. Whitewall tires the same thing, and on and on. You can name a dozen items you may be handling that have this kind of appeal. Find out why people buy what they do. Do this through study of the people themselves, and through study of books on the subject.

How To Reach: What is the best way for you to reach the greatest number of your prospects at the lowest cost? The answer could be by radio, newspaper, hand bills, etc. Advertising men call these media, or means, of reaching people. Large advertising agencies employ media men who study such things and make recommendations to their clients as to which media offers the best exposure.

If your business operation is big, it might be worth your while to retain an agency. In most every case, however, this is not within reason for a small service shop just starting out. In this instance media study will be handled on a do-it-yourself basis.

Newspapers offer one of the best media for independent repair shops. Often classified ads in local papers are more effective than display ads for small companies. Some people read the classified sections as sort of a hobby. They like to see what's going on in their neighborhood.

Then, too, most papers will help you prepare your ad. Remember, though, that you are responsible for your business policy. Listen to experienced advice, but make sure your ad says what you want it to say. First words

(Continued on page 78)

Get your PUROLATOR SEAL OF PROTECTION
STOP WEAR SAVE MONEY
CHECK YOUR OIL FILTER
GET YOUR PUROLATOR SEAL OF PROTECTION
PUROLATOR OIL FILTER

Banners, posters and streamers like these are also included in sales assistance manufacturers offer to the service shops. Materials of this type are usually tied-into seasonal service needs and/or national promotion programs to the public.

Tune-up . . . *(Continued from page 37)*

acting normally and there have been no complaints by the customer in this respect, nothing more need be done to this unit. However, if anything appears not to be normal, the combustion analyzer should be used to check carburetor performance and action. Always check to see that the carburetor hold down screws are tight.

EXHAUST SYSTEM

1. The exhaust manifold, muffler or mufflers, and tail pipe or pipes should be thoroughly inspected, and anything defective that is noticed should be called to the attention of the customer.

COOLING SYSTEM

1. The system should be checked for leaks, condition of water tubes, and pump.

2. Check the radiator for cool spots by feeling around the inner face of the core (engine stopped).

3. Check condition of all hose, fan belt or belts.

FINAL CHECKS

A final check which Walt feels is quite important is to put the car on the hoist and inspect visually the full length of the fuel line under the chassis from pump to fuel tank. The number of jobs where this inspection has revealed serious troubles that otherwise would go out uncorrected, is surprising. These defects are flattened spots in the metal gas tube, worn spots, and leaks.

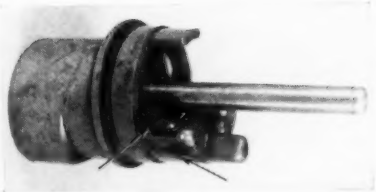
The last step in the program is to take the car out on the road and test it for operation and performance. This operation is the best insurance against customer comebacks or dissatisfaction and gives assurance that the work has been done satisfactorily.

Anti-Freeze Can Ruin Air Suspension System

● CHEVROLET AIR suspension units are controlled by a levelling valve at each air bellows. These are precision controls that do an excellent job when proper maintenance is practiced. Failures have been noted, however, in which there was evidence on the valve body and shaft assembly pictured here of the use of permanent anti-freeze in the vaporizer jar.

This vaporizer jar, mounted forward of the car radiator, must be kept half filled with denatured or wood alcohol —*never permanent type anti-freeze.*

Chevrolet literature warns owners, as well as mechanics, that the fluid level should be checked every thousand miles or oftener if severe cold temperatures are encountered. Also,



Valve body and shaft assembly from Chevrolet air suspension. Arrows point to blotches of stain and deposits resulting from the use of permanent anti-freeze in the vaporizer jar.

the air cleaner of the jar should be immersed in a cleaning solvent, air dried, and replaced every thousand miles.

An unsatisfactory ride or even total failure of the system can happen if the foregoing instructions are not carried out.

Torque-Flite Push Button Cable Adjustment Critical

The importance of correct push button, cable adjustment on the Torque-Flite Transmissions cannot be overemphasized, according to a recent Chrysler Service Bulletin. Improper adjustment or a kinked cable may

SUSPENSION PARTS without SUSPENSE

No come-back worries when you install Moog Under-Car Parts . . . designed and built to *fit better, last longer*!

Suspension parts have been Moog's primary business for nearly 40 years. No other manufacturer in this field offers you more experience . . . a more complete line . . . greater assurance of customer satisfaction.

Discover for yourself what leading wheel alignment experts know: The BIG ONE in SUSPENSION is MOOG!

MOOG INDUSTRIES, INC.
St. Louis 14, Mo.

MOOG
A GREAT NAME IN AUTOMOTIVE MAINTENANCE

MOOG MEANS MORE UNDER-CAR BUSINESS

cause erratic shift or possible front clutch failure.

If either of these conditions is experienced, the transmission oil pan should be removed before removing the transmission. With the oil pan removed, carefully examine the manual valve-lever detent ball to be sure it properly and fully engages in the respective manual lever detent notch. If the ball does not seat fully, the push button cable will require adjustment.

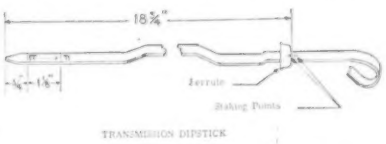
To properly adjust the cable, depress the reverse "R" button *and hold all the way in* during the adjustment. Loosen the cable lock-clip screw at the transmission manual valve lever housing. Push the cable into the housing until it stops. Then scribe a mark on the end of the cable at the housing and carefully pull the cable from the housing. Stop pulling just before the detent ball moves out of position.

Scribe another mark on the cable and divide the distance between the two marks. Push in the cable to this point. Tighten the cable lock-clip screw. Total travel between the two scribed marks, in most cases, will not exceed 3/32".

MOOG SPECIAL
STEERING DEVICES
"Poor man's power steering"
MOOG SHOCK ABSORBERS
Ride long and easy
after others fail
MOOG COIL SPRINGS
Designed with Built-in
Overload Factor
MOOG COIL ACTION
Original designs available
exclusively from Moog
MOOG OVERLOAD SETS
Complete line . . . autos to heavy trucks
MOOG LEAF SPRINGS
Electrically heat-tempered heavyweights
MOOG BALL JOINTS
Eliminate stud end-play
MOOG KING
BOLT KITS
Solid bushings . . .
precision fit
MOOG TIE ROD ENDS
With "Gusher-Bearings"
for longer life
get on the BEAM with
Brakes Exhaust And Moog
Sell safety, comfort and economy. Sell the complete under-car job! That's the big idea behind Moog's BEAM program. See your Moog Jobber for profitable details.

Loose Dipstick Cap Causes Inaccurate Reading

According to a recent DeSoto Service Bulletin, there have been a few reports of inaccurate oil level indicator (dipstick) readings on 1958 DeSotos with Torqueflite or Powerflite transmissions. The factory re-



TRANSMISSION DIPSTICK

ports that the cause is due to the ferrule at the upper end of the dipstick working loose and allowing the dipstick to extend too far into the transmission oil pan.

This ferrule is staked in position, as shown in sketch, and serves as a stop on the dipstick and also a cap for the oil filler tube. To insure correct oil level readings, the dipstick should measure 18¾" from the center of the staking points to the end of the dipstick.

Service men should therefore make it a point to examine the ferrule whenever transmission oil level is checked, to make sure it is firmly staked at the correct location on the dipstick. If it is not in its correct location or appears loose so it could work out of position, it should be lined up between the staking points and brazed to the dipstick.

Watch How You Replace Directional Signal Lens

On 1958 Studebaker models (except Hawk models) the lens of the directional and parking light can be installed incorrectly, which places the hot spot of the lens out of position. Because of the curve in the splash panel in which the light is mounted, it was necessary to put the hot spot off center in the lens. The mounting screw holes being centered makes it possible to install the lens so that the hot spot is offset in the wrong direction.

The lenses are marked L and R for left and right, and should be installed so that the identification letter is at the top.

Headlight Aiming Tip

On all cars equipped with Level-Air Suspension, the engine should be running while aiming either the headlamps or an Autronic-Eye unit. This will insure an aim with the vehicle at operating height and trim.

Use proper shop lighting to brighten your profit picture! Frank Lee tells how to do this in the September issue of A.S.D.

Servicing air conditioners

With the increasing number of cars being air-conditioned for passenger comfort, a profitable business of installing, testing and servicing the units awaits the shopman who understands how and what makes them work.

Part III—G. M. Air Conditioning Units

By ED PACKER,
Member, S.A.E.

• FROM THE POINT OF VIEW of the customer who is having trouble with his air conditioner, the unit does one of two things—it does not cool sufficiently, or it cools too much.

From your point of view you know that failure to cool may be due to any one of a dozen things—from a slipping compressor belt to a worn-out compressor. And over-cooling *may* be the result of anything from a faulty hot gas valve to a stuck clutch.

There is a "family resemblance" in the air conditioning systems of all General Motors cars. Fig. 1 shows a 1958 Buick installation. If it were a 1953 Cadillac it would be similar from the service standpoint. The belt-driven compressor would run continuously. And the early compressor had different internal construction from the new one shown in Fig. 2. This newer compressor operates 5 pistons from a socket plate, and runs only when needed. Furthermore, the evaporator or cooling unit now almost universally found on the firewall of the various cars could just as well be in the trunk—as it was originally with Cadillac and Buick cars; it would just mean more "plumbing"—but the service fundamentals would not change.

Since an understanding of fundamentals is a basic need for all troubleshooting, let's review briefly what takes place when the air conditioner is on the job.

THE COOLING CYCLE

As the system is started up, heated low-pressure vapor is drawn into the compressor and discharged at high pressure into the condenser located forward of the car's radiator. In the condenser this high-pressure vapor, which in all General Motors air conditioners is Freon-12, changes to a liquid when cooled by the air passing through the condenser.

The liquid runs down inside the condenser and is

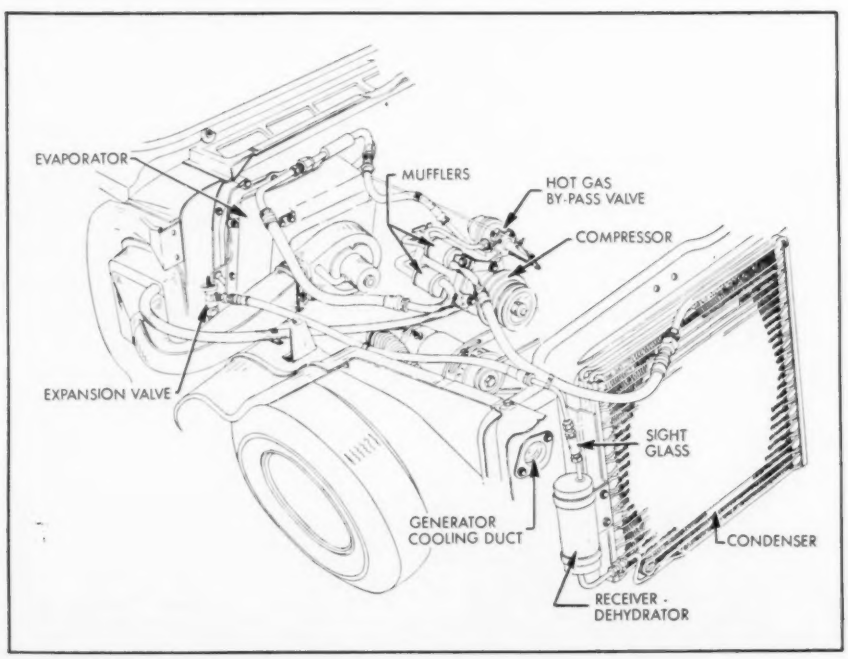


Fig. 1. Main unit of air conditioning unit as installed on a 1958 Buick.

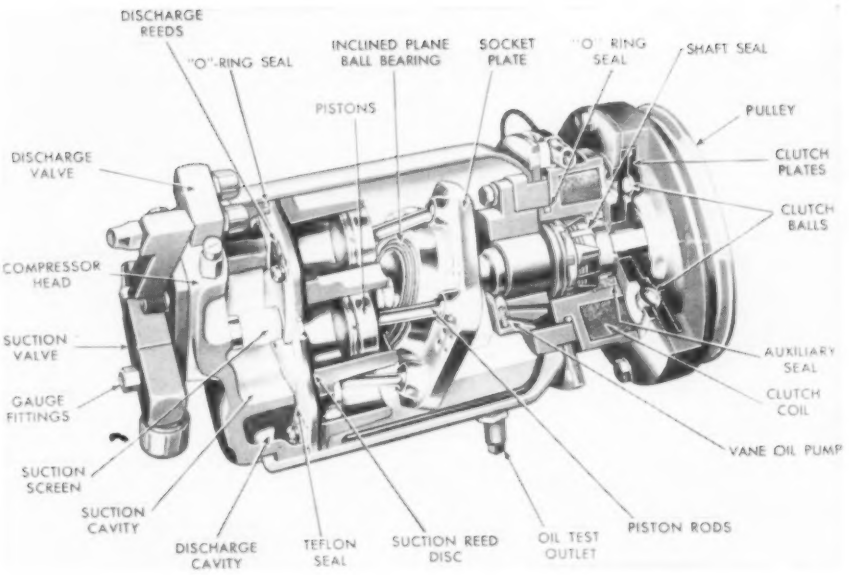


Fig. 2. Sectional view through a late-model axial type compressor, equipped with five pistons operated from a socket plate.

forced into the receiver (Fig. 1). The liquid flows from the receiver through a sight glass and a dehydrator-filter to the expansion valve at the evaporator or cooling unit.

It is at the expansion valve that the high-pressure liquid changes to a low-pressure liquid and enters the cooling coils by way of the distributor tubes. Then as the air-circulating blower forces air over the cooling coils, the liquid refrigerant once more becomes a vapor. This in turn is drawn into the compressor so that the cooling cycle can be repeated.

Tools and supplies necessary for trouble-shooting and servicing an air conditioning system are seen in Fig. 3. This is the equipment recommended by Cadillac. The main units are the same for all General Motors cars and, in fact, for service on most air conditioners.

These principal universal items include the vacuum pump, J-5428; the two gauges and their connecting manifold, all J-5725, and the leak detector, J-6084. Also universal for air conditioner service on any make or model would be the thermometer, goggles, tubing wrenches, connectors, and some other parts. (The J numbers identify tools available from the Kent-Moore Organization, Inc.)

"SMOKE TEST" CHECKS AIR MOVEMENT

Servicing the General Motors air conditioning systems must be limited in this article to the refrigeration phase.

It is self evident to experienced mechanics that delivering the cooled air satisfactorily to the passenger compartment is similar to the delivery of warm air. In each instance there must be a suitable blower operating and forcing the air through ducts. These ducts may be laid out in many ways and opened or closed by manual or automatic valves.

All we can say at this time is—give the delivery phase of the system the "cigarette test." That is, a little mechanical "savvy" coupled up with a puff of cigarette smoke will prove whether or not the air is moving satisfactorily from the heating or cooling unit to the desired outlet or outlets.

Just one more thing before going into the servicing of the various units that provide the desired *cooling* effect. This is lack of *adequate cooling* when the *air conditioner is apparently performing well.*

Beginning in 1957, heating coils were housed in the same chamber with the evaporator or cooling unit. So on any complaint dealing with insufficient cooling, your first step is to feel the tubes or hoses that run from the water pump or engine head to the heater to be very sure the car's heating system is not "fighting" the air conditioner. If these lines are hot, your whole service complaint will doubtless be solved by checking the heater and its controls, and not the air conditioner. However, unusually high readings on the high pressure gauge are a tip-off of the presence of this heat.

FAILURE TO COOL

The complaint that an air conditioner fails to cool satisfactorily calls for a *performance test.* This will prove to be a reliable guide for locating and correcting trouble in the system.

A setup for such a test is seen in Fig. 4. Here in a car with the doors closed, we have the engine tachometer hooked up, the thermometer (J-6076) checking the temperature of the air being delivered by the air conditioner, and the high and low gauges attached. The manner of connecting the gauges at the engine is pictured in Fig. 5.

In order to get the full value from our test it is necessary to get the "feel" of what these gauges do, and how they are used. This gauge set is always used when purging the system of its refrigerant, evacuating air and moisture, charging, or diagnosing trouble in the system.

(Continued on following page)

Johnny Buntin, air conditioning specialist with Slaton Chevrolet of Ft. Lauderdale, Fla., assisted in the preparation of this article by reviewing the copy and illustrations for technical accuracy.

Johnny is a graduate of all Chevrolet Service Schools conducted during the past thirteen years and is a Certificated Specialist on automatic transmissions, air suspensions, air conditioning and other units.

Air Conditioning . . . CONTINUED

The gauge at the right in Fig. 5 is a low-pressure gauge. It reads from zero to 150 lb., and also from zero to 30″ of mercury on the vacuum side. This gauge is always connected to the low-pressure side of the system.

The gauge at the left in Fig. 5 reads from zero up to 300 lb. pressure. Obviously this is used on the high-pressure side of the system.

The center gauge line should be kept plugged or capped, as indicated in Fig. 5, except when needed for some special purpose. Special purposes would include adding refrigerant, discharging refrigerant, purging or evacuating the system.

Gauge connections should be installed hand-tight only or the rubber seats will be damaged. The connections should be leak tested before proceeding.

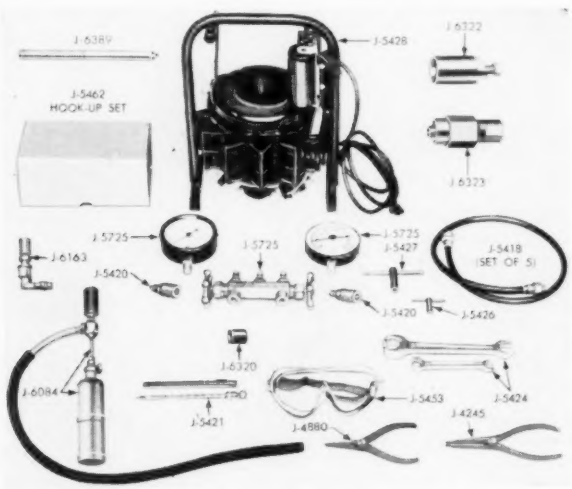


Fig. 3. Tools and equipment necessary for troubleshooting and servicing an air conditioning system.

The hand shut-off valves on the gauge manifold do not control the opening or closing off of pressure to the gauges; they merely close each opening to the center connector and to each other. During most diagnosing and service operations, valves must be closed. The only occasion for opening both at the same time would be to bypass refrigerant vapor from the high pressure to the low pressure side of the system, or in evacuating both sides of the system.

The metal internal parts of the General Motors refrigeration system, and the refrigerant and oil contained in the system remain chemically stable so long as pure Freon-12 plus refrigeration oil is used. But when abnormal amounts of foreign material such as dirt, air, or moisture are allowed to enter the system—as when the system is left open—the chemical stability may be upset. When accelerated by heat these contaminants may form acids and sludge, and eventually cause the break-down of components within the system. In addition, contaminants may affect the temperature-pressure relationship of Freon-12, resulting in improper operating temperature and pressures and decreased efficiency of the system.

PRESSURE-TEMPERATURE RELATIONSHIP

If we know the temperature of the liquid in the cooling coil or the receiver we can refer to a pressure-temperature table and determine what the pressure should be. The figures can also be used in a reverse manner—if we know what the pressure is at any point in the system we can refer to the accompanying pressure-temperature table and determine what the temperature should be.

PRESSURE-TEMPERATURE RELATIONSHIP OF "FREON-12"

Temp. °F	Pressure	Temp. °F	Pressure	Temp. °F	Pressure	Temp. °F	Pressure	Temp. °F	Pressure
-8	5.4	22	22.4	52	49.0	82	87.0	112	140.1
-6	6.3	24	23.9	54	51.0	84	90.1	114	144.2
-4	7.2	26	25.4	56	53.0	86	93.2	116	148.4
-2	8.2	28	27.0	58	55.4	88	96.4	118	153.0
0	9.2	30	28.5	60	58.0	90	99.6	120	157.1
2	10.2	32	30.1	62	60.0	92	103.0	122	161.5
4	11.3	34	32.0	64	62.5	94	106.3	124	166.1
6	12.3	36	33.4	66	65.0	96	110.0	126	171.0
8	13.5	38	35.2	68	67.5	98	113.3	128	175.4
10	14.6	40	37.0	70	70.0	100	117.0	130	180.2
12	15.9	42	39.0	72	73.0	102	121.0	132	185.1
14	17.1	44	41.0	74	75.5	104	124.0	134	190.1
16	18.4	46	43.0	76	78.3	106	128.1	136	195.2
18	19.7	48	45.0	78	81.1	108	132.1	138	200.3
20	21.0	50	47.0	80	84.1	110	136.0	140	205.5

With the gauges and instruments arranged as in Fig. 4, the hood up, an 18″ or 20″ fan in front of the car blowing toward the condenser, and the engine at 1,500 r.p.m., let the system "settle out." This requires running approximately 10 minutes with controls set for maximum cooling and full blower speed. Be alert for carbon monoxide and to see that the automatic transmission stays in *Neutral*.

In the performance values for the various cars (see Fig. 6), the ideal gauge readings are given. Where observed readings differ from these, the following conditions are likely:

SYMPTOMS AND PROBABLE CAUSES	*DIAGNOSIS OR SERVICE PROCEDURE*
High Gauge Reading on High Side of System:	
a. Air or excessive refrigerant in system.	a. Check complete system for leaks. Where detected, discharge system, repair leaks; then evacuate and recharge system with a complete charge.
b. Blocked air circulation through condenser.	b. Clean condenser with stiff brush, compressed air, or cool water. Never use steam!
c. High engine temperature.	c. Perform required engine maintenance.
Low Gauge Reading on High Side of System:	
a. Shortage of refrigerant.	a. Check for shortage, locate leak and repair. Add refrigerant as required.
b. Faulty compressor.	b. Replace serviceable parts or compressor (See dealer's parts man).
High Gauge Reading on Low Side of System:	
a. Clutch or belt slipping.	a. Check clutch and belt and make necessary repairs.
b. Excessively high head or high side pressure.	b. Check system for leaks. Discharge system, repair any leaks found, then evacuate and recharge system.
c. Over-feeding of expansion valve.	c. Check expansion valve for poor bulb contact to suction line. Replace valve if necessary (Fig. 7).
d. Faulty compressor.	d. Replace compressor if found to be faulty and unrepairable.
Low Gauge Reading on Low Side of System:	
a. Shortage of refrigerant.	a. Check for leak, repair leak, and recharge system.
b. Clutch will not disengage.	b. Check lever adjustment. Remove clutch pulley and replace internal parts of clutch if necessary.
c. Restriction in liquid line, suction line, receiver-dehydrator, or screen at expansion valve.	c. Check lines for kinks and replace lines if kinks are found. Check receiver-dehydrator. If partially stopped up, it will be cold or frosted. Check expansion valve. If partially stopped up, it will be cold or frosted at that point.
d. Cooling coil dirty or iced up.	d. Check cooling coil. If dirty, clean coil with cold water. If iced up, defrost coil and check hot gas valve and expansion valve.

LEAKAGE TEST IS IMPORTANT

Loss of Freon-12 is the cause of many a service complaint, so a thorough leak test is good comeback insurance.

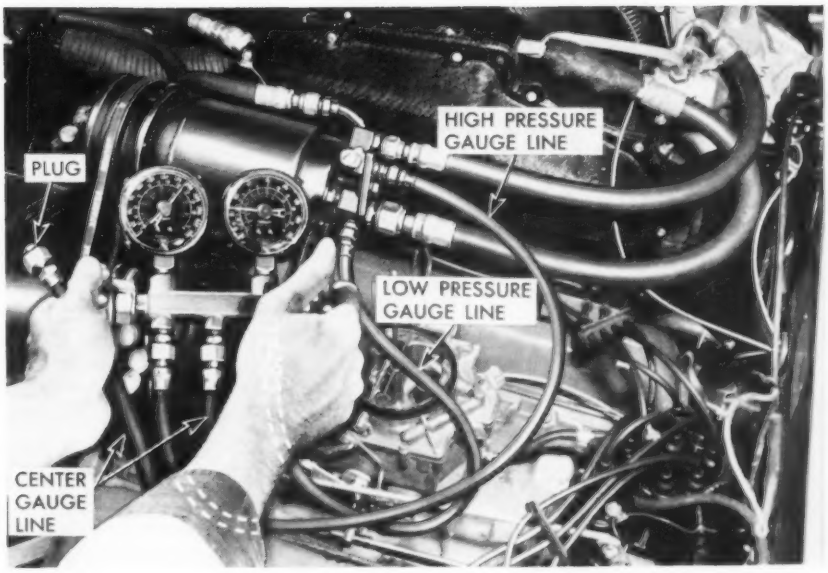


Fig. 5. Hook-up of high and low pressure gauges when making the performance test.

The tester described previously—and seen in Fig. 8—will show *yellow* when the sampling tube is in the presence of a small leak of Freon-12,—*vivid purplish-blue for a large leak.*

Look in the vicinity of a large leak for the appearance of oil. Compressor oil circulates in the system with the Freon-12. And a large loss of Freon-12 can endanger the compressor, due to an accompanying loss of oil.

Note the oil test outlet at the bottom side of the compressor in Fig. 2. As part of a routine service check, or when there is reason to believe that oil has been lost, proceed as follows:

1. Set controls for maximum output of air conditioning system, and operate engine and compressor at slow idle for 5-7 minutes. Stop engine.

2. Loosen the screw in the oil test fitting and allow a light seepage of oil to escape. Then retighten the screw for a moment.

3. Crack open slightly the oil test fitting screw once more. Then:

Fig. 4. Setup for making a performance test, using engine tach, thermometer and high and low pressure gauges (held in place with masking tape).

a. If a steady flow of oil is evident, the oil is either at or above the safe minimum level, and no additional oil is required.

b. If no oil escapes, or a hissing of escaping vapor only is observed, it is an indication that the oil is below the safe minimum level, and oil should be added to the compressor. Use only special Frigid-

(Continued on following page)

Fig. 6. PERFORMANCE TEST SPECIFICATIONS
(as taken from respective shop manuals)

Car	Outside Air Temp. Degrees F.	Air Cond. Outlet Temp. Degrees F.*	Engine R.P.M.	Low Pressure Gauge*	High Pressure Gauge
Buick	70	40-46	1600	22-25	110-150
	80	42-49		22-25	140-215
	90	43-52		22-25	185-265
	100	45-55		22-25	220-285
	110	52-56		24-26	260-310
Cadillac	70	39-41		29.5-30.5	195-205
60-62	80	43-45		27.5-28.5	255-265
Series(2)	90	47-49		27-28	295-305
	100	54-56		27-28	300
Chevrolet	70	45-52	1500	29.5	140-160
	80	45-54		29.5	145-220
	90	46-56		29.5	190-250
	100	48-60		29.5	210-280
Oldsmobile	70	43	460- 505	34(1)	130
	80	46	650- 715	34	187
	90	49	850- 935	34	245
	100	53	1130-1240	34	285
	110	59	2050-2250	34	330
Pontiac	70	46.5	600	34(1)	
	80	48.5	1060	34	
	90	52	1780	34	

** On extreme dry days, suction and air conditioner temperatures are lower—higher on humid days.*

(1) 34 lb. should be maintained at Schrader valve of evaporator.

(2) All pressures on the 75 Series should be 2 lb. lower than 60-62 Series.

aire oil from a General Motors dealer for this purpose. Oil can be added as a bench job to a compressor that has been removed.

Another method of adding oil is as follows:

1. Depressurize the system and remove the Schrader valve core from the low pressure gauge fitting.

2. Using a charging line and suitable funnel, pour

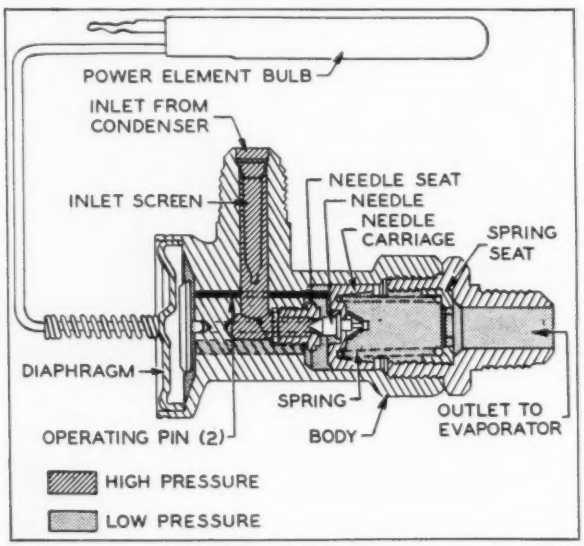


Fig. 7. Non-adjustable expansion valve.

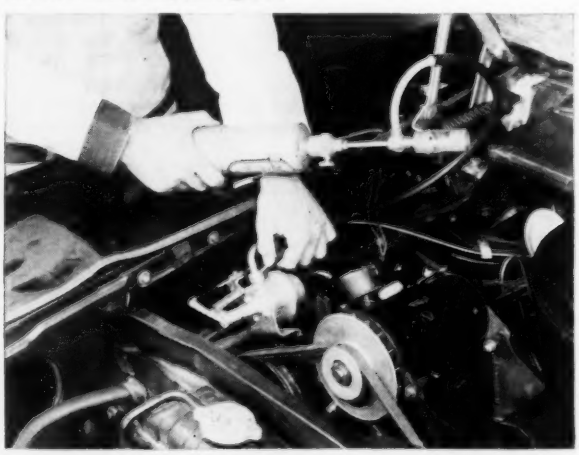
approximately 4 oz. of clean refrigerator oil in through the gauge fitting, and replace the Schrader valve core.

3. With the gauge set connected to compressor, evacuate and charge system.

4. After the system has operated for approximately 10 minutes, recheck oil level. If still low, repeat steps 1 through 3.

To remove any line, the compressor, or other component of an air conditioning system requires purging the system of its refrigerant. Use caps or plugs to keep lines and other components closed while awaiting installation.

Fig. 8. A thorough test with Propane fired refrigerant leak detector should be made of entire system, including compressor, valves, connections, tubing, etc.



And after repairs are complete, air and moisture in the system must be evacuated and the system recharged with Freon-12. To do this, the gauge set with its manifold is installed as in Fig. 9 for evacuating and recharging by the vacuum pump method.

If a vacuum pump is not available, the compressor can serve as a vacuum pump. In that event the special T-connector of Fig. 9 is omitted as is the vacuum pump and its attachments, and the Freon supply, either in a drum or disposable cans, is connected directly to the center fitting of the gauge manifold (Fig. 10).

PURGING AND EVACUATING

With the center connection of the gauge manifold

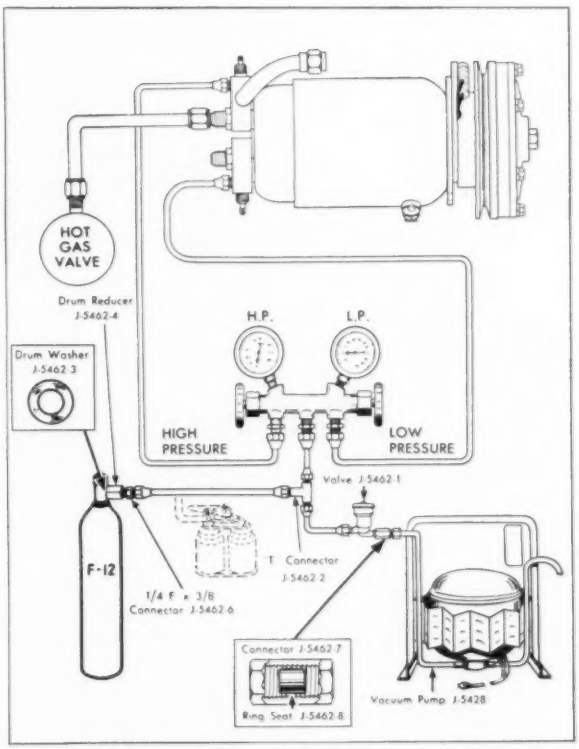


Fig. 9. Gauge connections for evacuating and adding refrigerant, using vacuum pump.

detached for the moment from its position in Figs. 9 or 10, proceed as follows:

1. Open both compressor hand shut-off valves ¼ turn.

2. Open high-pressure gauge valve and discharge the vapor *slowly* through the center connection of the gauge manifold. **Caution: Do not open valves suddenly or too much, or compressor oil may be discharged with the Freon-12.**

3. When the pressure is reduced below 100 lb. on the high-pressure gauge, then open the low-pressure gauge valve and continue discharging until pressure drops to 5 lb. or less. Close both gauge valves.

4. Close both compressor hand shut-off valves by turning fully clockwise.

The entire system is now purged of Freon-12 so that any part can be replaced. Keep all parts capped or plugged until ready to install to exclude dirt and moisture.

Whenever the air conditioning system is open for any reason, it should not be put into operation again until it has been evacuated to remove air and moisture which may have entered.

The preferred method of evacuating is with the use of the vacuum pump, as diagrammed in Fig. 9.

With the vacuum pump method, the system should be kept under a 28 inch vacuum for 10 minutes.

With the compressor methods, start the engine and allow it to run at idle to obtain a vacuum of approximately 28 inches for 5 minutes.

ADDING REFRIGERANT

When Freon-12 has been lost by replacing some component of the system or by the presence of a leak, the system can be charged as follows:

1. See that gauge and manifold set is connected as in Fig. 9 and Fig. 10.

2. Start engine, adjust air conditioner to maximum output, and operate for 5 min. at approximately 1,500 r.p.m.

3. Looking through the sight glass, note whether there are any bubbles evident in the Freon.

   a. If no bubbles are noticed, then bleed the system slowly through the discharge valve until bubbles appear in the sight glass. Then add a "shot" of Freon-12—just enough to remove the bubbles.

   b. If bubbles are visible through the sight glass it indicates partial or complete stoppage in a line or a shortage of Freon-12. To check for stoppage in a line feel along all lines. If the stoppage is in a low pressure line the line will be cold—possibly frosted—where plugged. If the stoppage is in a high-pressure line the plugged condition will result in *heat* at the point where the line is plugged. Replace the plugged line with a new one. Then after evacuating the system, add Freon-12 until the glass clears. To be doubly sure, perform the operational test pictured in Fig. 4 to see that the system conforms closely to the values given in Fig. 6.

It would be unfair to claim that the foregoing instructions can take the place of days of schooling or can give all of the details incorporated in manufacturers' manuals. But what is given here is highly useful in several ways—it is helpful groundwork for those who hope to attend a factory school. For all mechanics it will solve the great majority of problems encountered in shooting trouble and servicing these air conditioners.

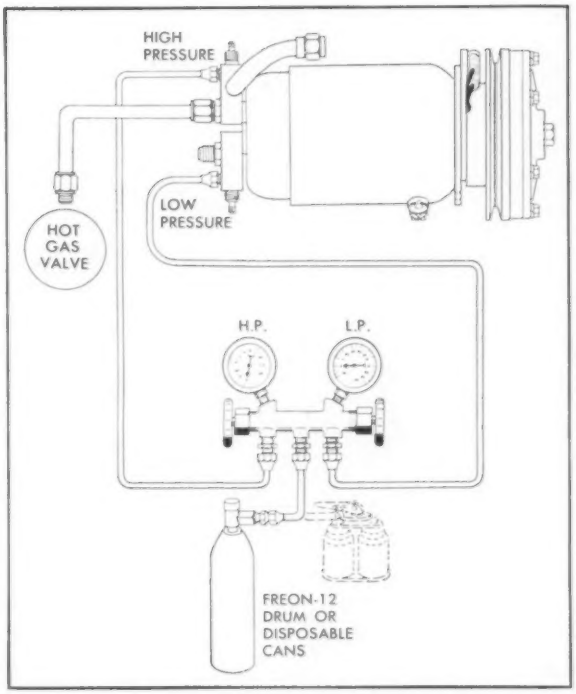


Fig. 10. Gauge connections for evacuating and adding refrigerant, using compressor as vacuum pump.

Champion 100-Mile-An-Hour Club Adds Four New Members to Roster

The Champion 100-Mile-An-Hour Club, sponsored by the Champion Spark Plug Co., added four new names to its roster of racing "Champions" at its recent pre-race meeting at the Indianapolis Athletic Club. Qualifications for membership in "the most exclusive club in the world" entails driving the complete Indianapolis "500" at an average speed of 100 miles an hour or better without relief. Currently there are 58 active members.

New drivers joining the Club were Gene Hartley, Johnny Boyd, Marshall Teague and Jack Turner.

Presiding over the meeting was the Club's retiring president, Jimmy Jackson. Mauri Rose, three-time winner of the speed classic, was elected the new president.

Newest members of the Champion 100-Mile-An-Hour Club receive their scrolls from Col. A. W. Herrington, Chairman of the Club's Board of Governors. They are (left to right): Gene Hartley, Johnny Boyd, Col. A. W. Herrington, Marshall Teague and Jack Turner.

To complete your "Tech-Know-How" file on Universal Joints . . . be sure to see, and save, the concluding article of this comprehensive series in September.

Home Training Program in

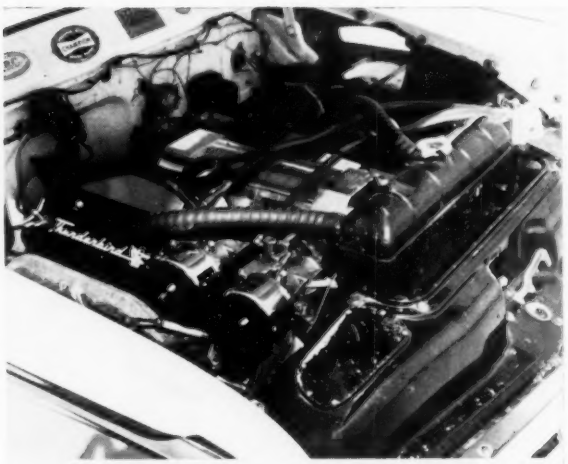
AUTO MECHANICS

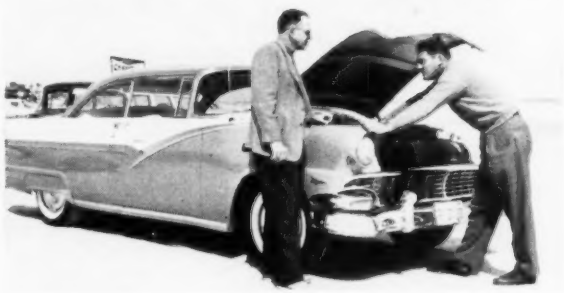
A comprehensive program which serves excellent for review or reference. Ideal for the man who has picked up a little here and there and wants to systematize his knowledge. Employers interested in sponsoring the program for selected employees can take advantage of tuition discount plan. Write for free information.

ALLIED INSTITUTE OF TECHNOLOGY
1338-42 So. Michigan Ave., Dept. ASD-88, Chicago, Ill.

PHOTOS
from here and there

Easy viewing features the AC rust-proofed spark plug, "Space Pac." The transparent packaging was designed as a retail display as well as an individualized container for eight marine plugs. Card hanger is perforated for easy removal of one or more plugs.

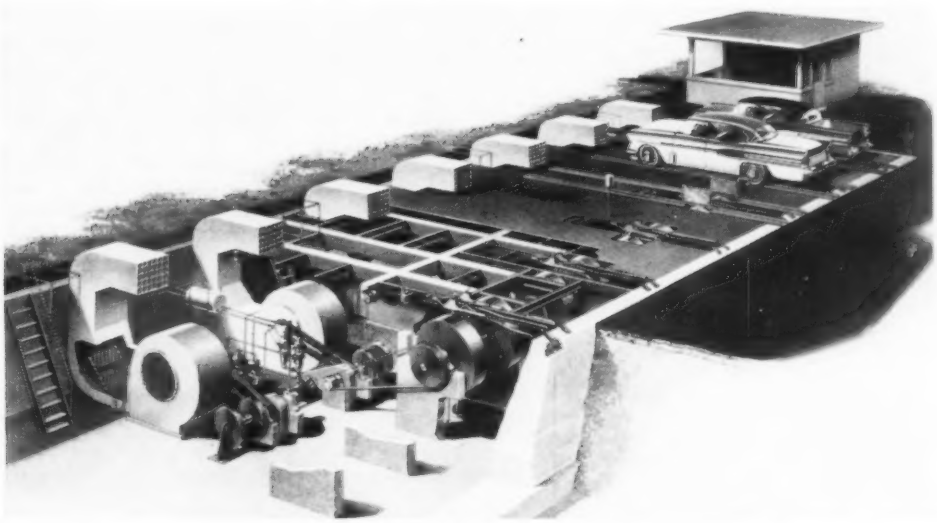




"Let's take a look under the hood," says Robert K. Christie (left), Champion Spark Plug Co.'s vice president in charge of engineering and research. The car is a supercharged 1956 Ford Victoria owned by Karol Miller of Houston, Texas, who recently drove it across the NASCAR Daytona Beach measured mile at an average speed of 153 m.p.h.

Yesterday's car today. For persons who like something a bit different, here's the Surrey, 1958 version of a 1903 car, complete with tiller, polished brass headlights, bulb horn and wooden spoke wheels mounted on Goodyear studded tread bicycle tires. It has a 4.8 horsepower air-cooled engine; top speed is 35 mph, and fuel consumption 65 mpg. Dyer Products Co., Canton, Ohio, sell it.

The Italian Zust shown as it appeared shortly after the start of the New York-to-Paris race that began in Times Square, New York, February 12, 1908. Besides the driver there were two relief drivers and the mechanic. This car did not reach Paris until the following September 17.

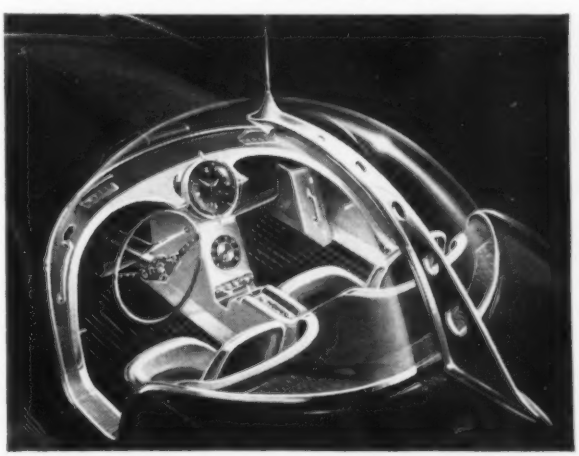


Esso's Research and Engineering Company's new automated treadmill for test cars in Linden, N.J. Driverless cars are operated from control house by magnetic tape recordings, duplicating acceleration and braking cycle of road vehicles.

"Inertia disks" absorb power car would normally use to accelerate its weight on a road.

This mechanical giant unloads 25 tons of sugar cane in a matter of half a minute. Engines in the truck and crane are diesels. Quite an outfit to service, too. The scene is in the Hawaiian Islands on a 110,000-acre sugar cane plantation.

Not a '59 preview, but the interior of the Astra-Gnome "time and space car." The Gnome was introduced at New York's recent International show. Cockpit features a Hamilton celestial time zone clock and blue and silver leather upholstery.



By HERB CARRIER
Detroit Editor

Fuel control systems

Converting liquid gasoline into mechanical energy involves more than carburetion. Air filters, manifolding and exhaust systems—all play an equally important role in providing efficient, economical engine operation from tank to tailpipe under constantly changing conditions.

Part I—Feeding 8-Billion Horses

• TODAY, IN THE UNITED STATES, there are approximately 67 million registered automotive vehicles. The engines of these vehicles are capable of generating over *8 billion* horsepower! Actually more horsepower than *50 times* the combined capacity of all the central generating stations in the entire country.

Food for this fantastic mass of power-producing machinery is mainly gasoline and air in huge, almost unbelievable quantities. In 1956, for instance, about 55 billion gallons of gasoline were consumed on our highways. For every gallon of gasoline used, 10,000 or more gallons of air rushed through carburetors to form combustionable fuel-air mixtures (see AUTOMOTIVE SERVICE DIGEST, March 1958, page 28).

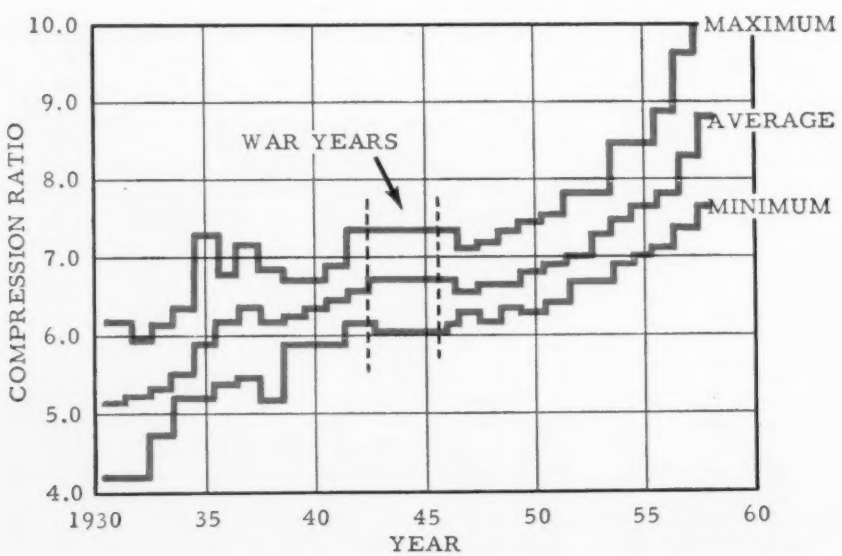
Many factors must be taken into consideration when discussing the manner by which latent energy in liquid gasoline is converted into mechanical energy to power modern day automotive vehicles. There are several vital mechanical components involved, a dash of chemical actions, and a strange paradox of material behavior.

Gasoline itself will not burn. It must be mixed with air to form a combustionable mixture. Yet oxygen, the substance most of us mean when we say air, will not burn either. It merely supports combustion.

The atomizing of gasoline, and the mixing of air with the bits of liquid to form a mixture suitable for burning within the combustion chamber of an internal combustion engine, are the basic problems of fuel control as it applies to the automotive field. This basic problem is multiplied many times by the constantly changing conditions under which the engine is operated. An average car engine may be operated under no-load, half-load, full-load, and any point in between, many times per mile of driving. For efficiency of operation, the fuel control system must instantly adapt itself to these changing conditions, and deliver just the right mixture in the right quantity to satisfy the demands of the engine.

WET AND DRY ROUTE

Two routes are commonly thought of when talking about the fuel control system: The wet route, and the



Engine compression ratios have steadily increased from an average of 5.0:1 in 1930 to an average of 8.8:1 in 1957. Apart from a general beefing up and slight modification, the fuel control system has changed very little.

dry route. The wet route starts at the gas tank and goes through the gas line from the tank to the fuel pump. From the pump it leads through another line to the carburetor and reservoir. Leaving the reservoir, it enters the carburetor venturi where it meets with the dry route.

The dry route starts with air entering the air cleaner. After a filtering process, the air enters the carburetor air horn, and proceeds to the carburetor venturi where it junctions with the wet route. At this point, even though the ensuing mixture is sometimes more wet than dry, the remainder of the trip is thought of as the dry route.

The mixture flows through the carburetor venturi into the intake manifold, passed the intake valves into the cylinder where it is squeezed into an average of ⅛ of its volume. Then it is burned, and the exhaust gases pass out the exhaust valve, into the exhaust manifold, through the exhaust pipe, through the muffler, and, finally, out the tailpipe.

Each step along the way of each route has many complications. There are engineers who are assigned the sole task of manifolding. Others are concerned entirely with carburetion. Still others solve only the problems of combustion. The working mechanic, however, must have a fairly comprehensive knowledge of all phases of fuel control if he is to adequately service the complete system.

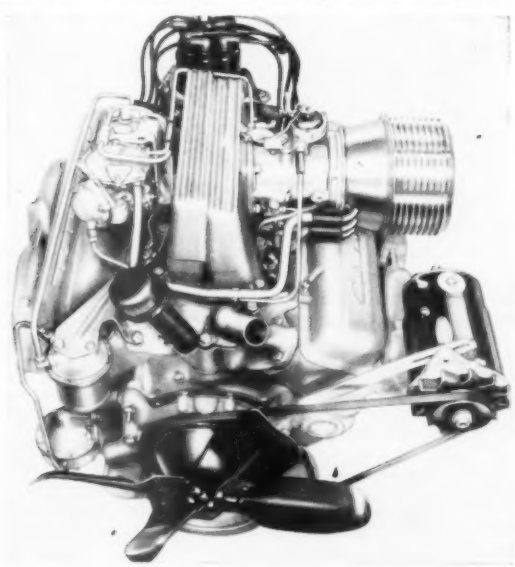
Fortunately, mechanics can do little to alter the basic design which the engineers develop. "I didn't build it, I just fix it" is still a valid comeback when irate customers start berating the design characteristics of their cars.

Over the years, there has been little change to the original design of the fuel system basic components. The fuel pump, for example, is still a fuel pump. It even looks much like the fuel pump that was used twenty years ago. There have been minor modifications, of course. The double acting pump which makes for better windshield wiper operation as well as pump fuel for the carburetor, could be termed a modification rather than a design invention. The electric and the submerged are two examples of "new" fuel pumps. These are limited application units, so far, and perhaps may never replace the fuel pump as we know it. The big change came from the gravity feed fuel system to the pressure feed system. Since then, there has been no dramatic changes.

Carburetors have changed little in design over the past twenty years. Their main purpose is to meter the amounts of gasoline fed into the incoming air stream to insure an adequate fuel-air mixture for the engine under any and all operating conditions. The carburetor throttle valve also provides an efficient means of controlling engine r.p.m. by limiting the amount of fuel-air mixture which is allowed to enter the engine's intake manifold.

The same holds true for the carburetor. Today's four-barreler might look like the efforts of a slightly inebriated plumber, but its function and operation is just about the same as the old single-throat job. Fuel injection is the "new" entry in this area, but, here again, it's a limited application unit and may never appear in enough volume to unseat the carburetor.

Fuel injection systems have enjoyed limited popularity in the last two or three years. Because of relatively high initial cost, many feel that these systems will never replace the carburetor. Theoretically, fuel injection is more efficient than carburetion, but because of its complexity it is more prone to misadjustment.



WET ROUTE PROBLEMS

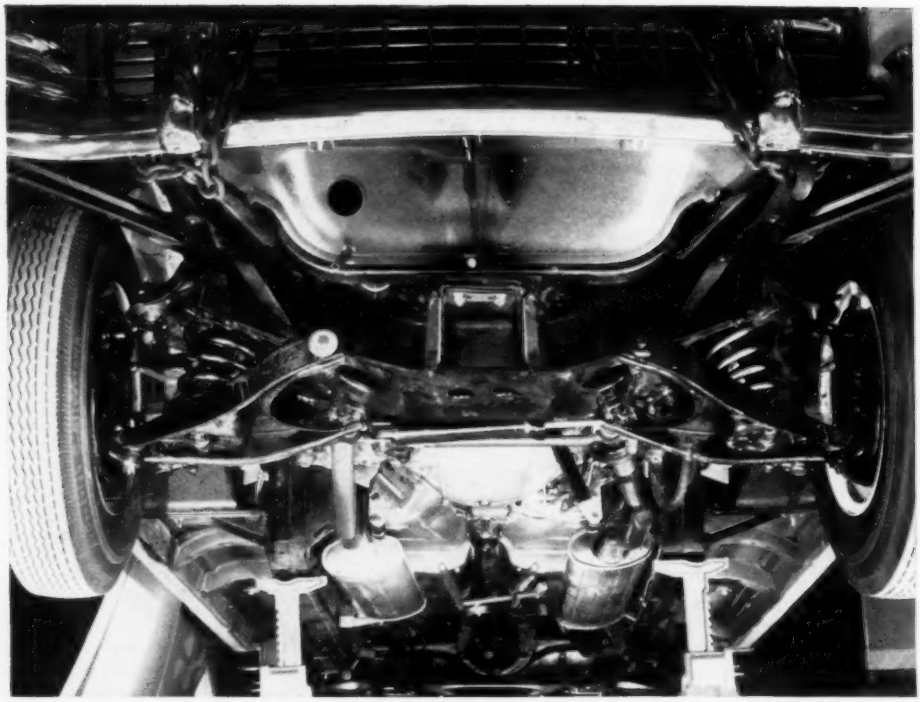
Gas tanks today represent very little trouble as far as the service mechanic is concerned. It's possible for the tank to become accident damaged and to require replacement, or to necessitate replacement because of excessive rusting or leaking. In either case, the replacement procedure is quite simple and is easily performed. Most every gas tank in use today has a simple Full-Empty indicating device, but this is usually serviced as part of the electrical system.

Gas lines from the tank to the fuel pump are usually metal tubing. This, also, gives very little trouble. Some cars struggle through their entire life span with the original gas line. When one does require replacement, most mechanics can quickly slip a new one into place by using copper tubing with brass fittings.

Fuel pumps are the wet route components most likely to need periodic attention. From time to time, the sediment bowl must be cleaned. Occasionally, the pump cover screws will need a general tightening. And, because the pump is a working part rather than a storage part as in the case of the gas tank, it is more apt to require replacement.

Reliable gauges are available which permit quick and accurate diagnosis of fuel pumps. Generally, pump manu-

(Continued on following page)



Dual exhaust systems are fast becoming standard equipment on all V-8 engine installations. By using two exhaust systems, exhaust back pressure is held to a minimum. Eliminating the cross-pipe and engineering a straight-through flow of the exhaust gases increases exhaust system efficiency.

Fuel Control . . . CONTINUED

facturer's specifications list a vacuum and a pressure check. To conduct the vacuum check, the gauge line is inserted on the intake side of the pump, and the engine operated long enough to obtain a reading on the vacuum side of the gauge dial. This test will reveal if the pump is efficient enough to pull fuel from the tank and supply line.

The pressure test is conducted on the other side of the pump. The gauge line is actually connected between the pump and the carburetor. Again the engine is operated momentarily to obtain a pressure reading. Some manufacturers recommend taking pressure readings at engine idle. Others suggest idle and 3,000 r.p.m. Some engineers claim that an accurate reading can be obtained at cranking speed. In all instances, it's best to follow the manufacturer's specifications as to test procedure. He's the one who made the pump; he should know the best way to check it. If a fuel pump does show up as being under par, it can be replaced with very little technical difficulty. The hardest part of replacing many pumps is getting to them. Invariably, they're in the most awkward locations.

CONDENSATION

Condensation is the gremlin of the wet route. It can form in the filling station tanks as well as in the car's tank. Warm days and cool nights, or cold days and colder nights, set up perfect conditions for condensation. If reasonable care isn't taken by the station attendant and the car owner, it's possible to build up considerable quantities of water in the wet route. This is bad because gasoline and water don't mix. The water, being heavier than gasoline, tends to settle to the low spots of the system. These low spots include the tank itself, dips in the gas line, and the lower section of the fuel pump sediment bowl.

When the ambient temperature falls below 32°F., the water freezes and cuts off the fuel supply to the carburetor. When this happens, steps must be taken to thaw out the frozen spots. If the ice is all in the sediment bowl, this is no particular problem. Merely remove the bowl and shake out the ice. If the ice is in the supply line, or in the bottom of the tank blocking the supply line, the car could be towed to a heated garage and left sitting until the ice is thawed, or warm towels could be wrapped around the frozen parts. Sometimes introducing a commercial de-icer into the gas tank will cure minor freeze ups. However, this is usually a preventative measure and not a cure.

In the early days of motoring, car owners used to strain their gasoline through a chamois. This was a very effective way to remove the water as well as any other impurities that may have been present. Today, it's not necessary to go to this extreme. Gasoline is much cleaner for one thing, and the filling stations regularly service their tanks to remove condensation. One of the best techniques a car owner can apply to guard against excess condensation during freezing weather is to fill his tank at the end of the day's driving. A full tank offers less hospitality to condensation.

GUM DEPOSITS

Another nasty habit of the wet route—where it is exposed to air—is its tendency to form gummy deposits. These deposits plug up carburetor jets, stick linkages, and hamper the normal flow of air. A badly gummed-up carburetor must be dismantled and thoroughly cleaned. Mildly gummed surfaces can be cleaned effectively by commercial preparations which are either poured directly through the carburetor air horn, or into the gasoline tank. The only preventative is to use a good quality gasoline that leaves a minimum deposit.

DISEASES OF THE DRY ROUTE

Contributing its share of ailments, the dry route is prone to many malfunctions. Unlike gasoline, air is free and available in unlimited supply. However, in its raw

state, it can be very harmful to automotive engines. Most air is loaded with impurities; some of which are tough enough to scratch hard steel. Naturally, these impurities must be filtered out before the air is suitable for use. Therefore, the first component of the dry route is the air cleaner.

Two types of air cleaners are currently being used: The oil bath and the dry type. The oil bath type relies on the velocity of the incoming air for effective filtration. By means of design, the direction of the air being forced into the engine via the oil bath air cleaner is rapidly reversed from a downward direction to an upward direction. This sharp turn causes the heavy impurities to fall out of the airstream into the waiting oil reservoir. The oil acts as a trap, and prevents the foreign material from going any farther.

CONDITIONS MUST BE RIGHT

On its upward flight, the air stream goes through a fine wire mesh which filters out the smaller dirt particles. The mesh is kept moist by the incoming air stream, picking up droplets of oil from the reservoir and carrying them into the mesh.

Under certain conditions, the oil bath air cleaner does a very effective job. *But* conditions aren't always ripe for proper operation. For instance, if the velocity of the incoming air is too slow, due to low engine r.p.m., to allow the air to carry oil into the wire mesh, the small air born impurities may not be filtered out. If the oil supply in the cleaner reservoir is too low, it's possible that both the large and the small particles will remain suspended in the air stream. On the other hand, if too much oil is present in the air cleaner reservoir, it's possible that the air stream will carry oil droplets directly into the carburetor. This can cause erratic performance of the engine, and smoky exhaust.

The only thing a service mechanic can do to help the situation is to keep the air cleaner supplied with just the right amount of clean oil, and make sure the wire mesh is serviced regularly.

AIR VELOCITY NO FACTOR

The dry type air cleaner is not dependent upon air velocity for efficient filtering action. The incoming air must first go through a pleated paper element before it is allowed to enter the carburetor air horn. This paper element is efficient enough to remove even the smallest dust particles. It's just as effective at idle speed as it is at top r.p.m. However, it demands a little more attention, especially when the car is being operated under dusty conditions. The paper element is sometimes too efficient for its own good. It can quickly filter enough dust and dirt from the air to choke up the air passages through the paper. When this happens, the filter actually acts as an air restrictor, and the engine becomes starved for air.

The problem of a clogged dry type air cleaner is acute enough to cause one independent parts manufacturer to market a warning device which automatically closes an electrical circuit to a dash mounted warning signal. This unit is threaded into the intake manifold. When excessive vacuum is built up in the manifold, a diaphragm is pulled down to energize the circuit. The sensing diaphragm is made of oil resistant material, and will operate efficiently over a temperature range of $-40°$F. to $+250°$F. (see AUTOMOTIVE SERVICE DIGEST, July 1958, page 68).

Dry type air cleaner service consists of periodic cleaning of the paper element. The element can easily be removed from the filter. Excess dust is removed by gently tapping the element against a hard surface. Replacement element should be installed if the old one is unusually dirty, or if it has developed tears or cracks.

Today's carburetor is a finely calibrated unit consisting of several independent—yet interrelated—circuits. These circuits are commonly thought of as the float circuit, the idle circuit, the low speed circuit, the high speed circuit, and the accelerating circuit. Each circuit has distinct duties; they do much as their names indicate. The float circuit controls the level of fuel in the carburetor reservoir. The idle circuit controls the amount of fuel being used during engine idle. The high speed circuit does the same during higher r.p.m. The acceleration circuit supplies an extra squirt of fuel when the throttle is cracked open for a burst of speed. In addition to these basic circuits, some carburetors—most in fact—include a power circuit which enables the carburetor to deliver more fuel under full-load condition.

All carburetors are capable of giving long, trouble-free service *if they are kept clean.* As mentioned earlier, the gum which is deposited by gasoline is, perhaps, the biggest source of contamination for the carburetor. Jets that are partially, or wholly obstructed by gummy deposits cannot operate correctly. Surfaces of the carburetor which are exposed to the incoming air stream will set up undue turbulence if coated with "varnish". In almost every case of carburetor malfunction, the culprit is dirt, or foreign matter of one kind or another. Obviously, the word of caution is *keep the carburetor clean.* This applies to the outside of the carburetor as well as to the inside. Linkages which are prevented from operating properly because of sticky gum can't be expected to work right under such conditions. Sometimes control linkages are hopelessly

Condensation, or just plain water, is always a threat to the operation of a gasoline internal combustion engine. Controls such as the fuel pump sediment bowl will trap water before it is pumped into the carburetor. Being made of glass, it is easy to spot water or other sediment without removing the bowl.

clogged up at the pivot points because some uninformed mechanic covered them with lubricating oil. Linkages should never be oiled—they are designed to operate dry. An occasional brushing with lacquer thinner will remove most gum from the carburetor casting and the linkage assembly. But because of the extreme volatility of the thinner, a serious fire hazard is present. For this reason, most safety conscious individuals shudder at the mention of this cleaning process. Certainly, it's not one to be done sloppily. If done at all, it should be with a maximum amount of caution—and a ready fire extinguisher.

(Continued on page 76)

Standardized procedure ups muffler sale profit

● TODAY'S rapidly increasing muffler replacement market can provide service shops with a lucrative source of additional income, if the shops follow a set of simple suggestions offered by one of the leading muffler manufacturers.

According to Maremont Muffler Division, the greater acidity of today's high octane fuels results in faster deterioration of the automobile muffler and exhaust pipes—which are failing at a greater rate than at any time in history. Corrosive action by high-test gas additives is cited as another factor that causes mufflers to "wear out" faster than ever before.

The immediate result of this shorter muffler life, is of course, big replacement sales, and the trend toward more frequent need for new mufflers is likely to continue for some time, the Maremont staff predicts . . . as long as high-octane fuels, with their corrosive additives, remain in general use.

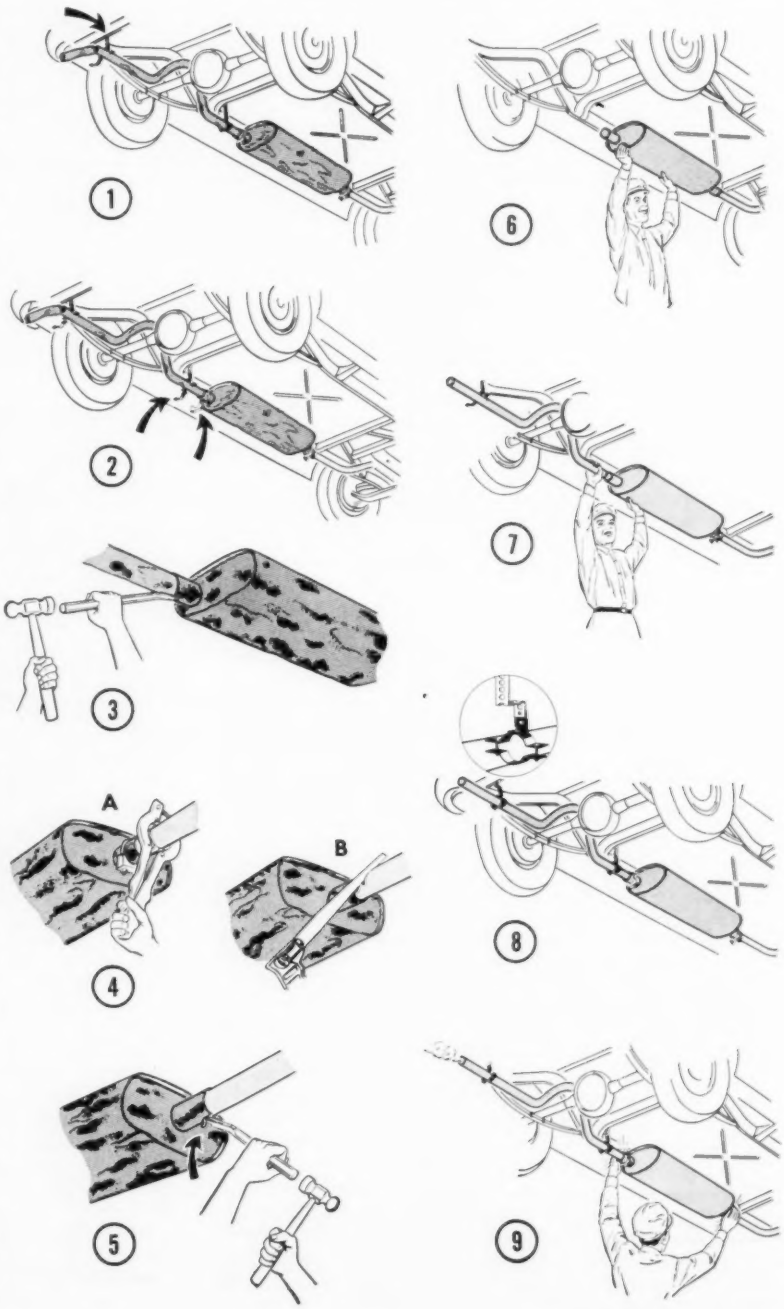
Temporarily at least, there is another important factor contributing to bigger replacement muffler sales . . . the decline in new car purchasing. With far more car owners keeping their present cars beyond their usual trade-in period, more than the usual number of drivers are in the market for a new muffler. At the present time, there are over 67 million registered cars on the nation's roads, an all time high—and most of them are from two to eleven years old, well within the customary age bracket for muffler replacement.

To make muffler installation quick, convenient and profitable for the service shop, the engineering staff of Maremont Muffler Division has devised a simple, nine-step procedure for proper, speedy installation. Requiring only the simplest tools, the systematized method is designed to cut muffler installation costs to a minimum and enable the shop to reap maximum profit from the job.

The accompanying cuts present the step-by-step recommendations, from the time the car is up on the lift until it is ready to be rolled off and returned to the owner:

Step one is to remove the tail pipe from the rear hanger; from that point the sequence continues—2, remove tail pipe from front hanger, and remove rear muffler clamp; 3, insert lip of pipe peeler under muffler end tube, and with a few blows of a hammer, fold end tube back from tail pipe. Remove tail pipe from muffler; 4—A, remove front muffler clamp, or B, in cases where muffler has been welded on, saw through exhaust pipe ahead of the weld; 5, on clamp installations, remove muffler from exhaust pipe in the same manner you remove tail pipe; 6, install new muffler over exhaust pipe . . . be sure that muffler is in correct alignment so that the tail pipe will clear the frame and shock absorbers. Install front muffler clamp and tighten it securely. Be sure to leave ample clearance for that hand brake cable.

The seventh step—insert tail pipe into muffler outlet tube, install rear muffler clamp and tighten securely



(since muffler and tail pipe are installed together, and "wear out" together, they should be replaced at the same time for the most satisfactory results); 8, attach tail pipe to front and rear hangers; finally, 9, check thoroughly for leaks and rattles.

Watch the Air-Cooled Jobs

• IF YOU ARE rendering service of any kind on an air-cooled engine it is good business to check for clogged air passages between the fins. Illustrated are the fins of an engine that overheated badly—and no wonder.

Fins of air-cooled engine so clogged with mud and grass that damaging overheating resulted.

Mud is not a very good cooling agent except when it is first applied good and wet—then only for a moment. Actually the "gook" being dug out with a screwdriver was about like cement. Use your imagination as to what this condition on the *outside* of the cylinder did to the temperature, oil condition and rate of wear on the *inside*. And extensive damage does not require mud. Grass on lawn mower engines interfering with the free flow of air around the fins can cause extensive and expensive damage.

Accelerate Engine Slowly When Timing Ignition

When using a timing light to set ignition timing, it's a good idea to accelerate the engine slowly to see if timing advances smoothly. According to engineers of the Champion Spark Plug Co., it is possible for excessive wear in the bushing or distributor drive train to cause fluttering or "fanning" of the timing marks at certain r.p.m.'s. If this flutter exceeds 3°, it is recommended that the condition be corrected, as the engine is obviously not firing at the proper time.

Replacing Choke Piston Eliminates Engine Stumble

On late model Studebaker-Packards equipped with four-barrel carburetors, choke action can be improved to eliminate stumbling or hesitation when attempting to accelerate rapidly with a cold engine by replacing the choke piston with a new piston (Carter Part No. 160-117).

Also, the factory recommends adjusting the Climatic Control so that it is set two notches to the rich side from the index mark. (Standard factory setting is one notch past the index mark to the rich side.) The choke setting may vary somewhat from the recommended setting, depending on the climatic conditions and locality.

Keep Undercoating Material Away from Air Suspension

When undercoating cars equipped with air suspension, the undercoating material must not be allowed to contact the air reservoir bellows or lower control arm pistons. To do so can cause chafing of the bellows and eventual failure of the system.

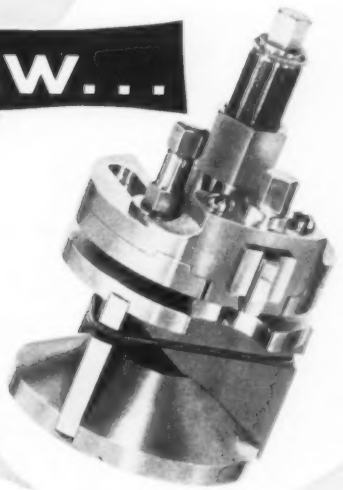
Air line fittings, junction block and hoses should be protected to prevent contact when applying undercoating.

BRAND NEW...

easy to use

Lisle

SR-9 RIDGE REAMER



...for Slant-block Engines

PRECISION LATHE ACTION
Proved best by mechanics coast to coast. Gets all the ridge with one setting.

FLOATING TUNGSTEN CARBIDE CUTTER
Never needs sharpening or adjusting. Follows worn cylinder contours and imperfections to remove all the ridge.

FULL 3" TO 5" RANGE
Jaws stay rigid all the way out.

Designed and engineered to remove the ridge in all cylinders . . . even the very latest angle-block (wedge-shaped) combustion chambers. Also handles all short-stroke and conventional engines.

SEE YOUR JOBBER TODAY

it's a good tool...it's a Lisle

LISLE CORPORATION
CLARINDA, IOWA

These are new *manufacturers' products*

HOW TO GET RUSH INFORMATION

If you want further information or literature describing the products shown in our "These Are New" pages, just use the handy Business Reply Card you'll find further back in this issue. Whether you want information on one or more of the products, all that is necessary is to mail this Postage paid card properly filled out to AUTOMOTIVE SERVICE DIGEST. Our Reader's Service Dept. will contact the manufacturers directly and see that you obtain the requested information as quickly as possible.

End Lift Jack

A new pneumatic end lift jack is announced by the Watervliet Tool Co., Inc., especially designed to take the place of the bumper jack. Called the "Iron Horse," it has a forward reach of 15", allowing the jack to lift the vehicle directly from the brackets or lift pads. No part of the jack is said to come in contact with the bumper or grille of the vehicle, thus completely eliminating any possibility of damage to chrome or bumper.

The lift jack has a capacity of over 3,000 lb., an adjustable spread of up to 52", and will raise even the heaviest car to its maximum height of 31" quickly and easily.

Optional with the Iron Horse is a Hi-Lift attachment, which allows the jack to be used for easy, safe "one man" removal and installation of springs and shock absorbers and for many other jobs where it is essential to remove the weight of the car from the part under repair.

(Use Reply Card for Further Information)

Wetzel's Tune-Up Book Revised

The popular and valuable book, *Automotive Diagnosis and Tune Up* by our Technical Editor, Guy F. Wetzel, has been revised and enlarged and is now ready for distribution.

The book contains carefully selected and edited material which many years of experience in the service business have proved to be of value to shopmen, tune-up men and students.

An informative chapter has been added on the oscilloscope. . . . The action and indications of the oscilloscope are analysed and explained along with the action of the ignition system which affects the indications of the instrument. Eacn make of oscilloscope is described.

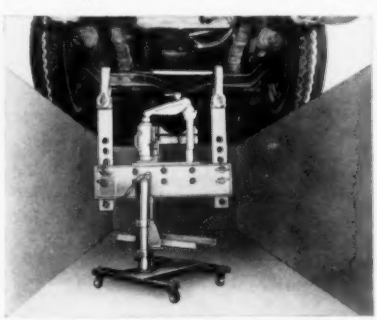
Another new chapter on tune up procedure gives concrete suggestions for a sensible and practical procedure.

The book is published by Master Technical Press, Park Ridge, Ill. It contains 550 pages and 600 illustrations, and priced at $6.45, postpaid.

(Use Reply Card for Further Information)

Heavy-Duty Axle Press

A new, heavy-duty, portable axle press that is said to concentrate a force equal to seven 30-ton jacks in one spot, has been announced by the Bear Mfg. Co. for use in either service



or lubrication pits to straighten axles cold, right on the job, without removing them from the vehicle.

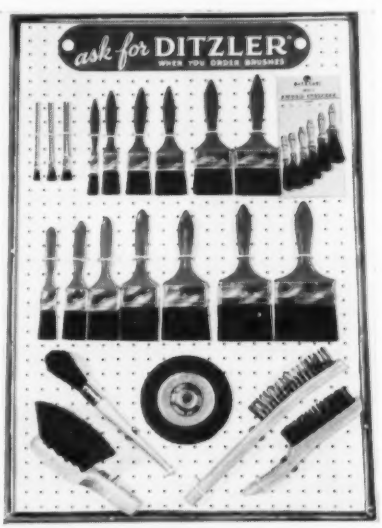
According to the manufacturer, when using the new Model 8310, it is possible to increase camber on both wheels of the heaviest bus, truck or trailer axles cold, individually or simultaneously, thus preserving the special heat treatment put in by the factory, with no significant chemical change in the axle. The unit can also be used for making fore and aft bends so that axles may be twisted to proper caster position.

To facilitate ease of handling, the press is mounted on a pit dolly which rolls the press into place under the axle. A hydraulic ram incorporated in the dolly lifts the press into position quickly and easily.

(Use Reply Card for Further Information)

Ditzler Adds Brushes to Line

Following a comprehensive field survey and review of all brush types required for auto refinish shop work,



Ditzler Color Div., Pittsburgh Plate Glass Co. announces a compact line of utility brushes. The colorful jobber display panel shown here contains one brush of each size and type being offered.

(Use Reply Card for Further Information)

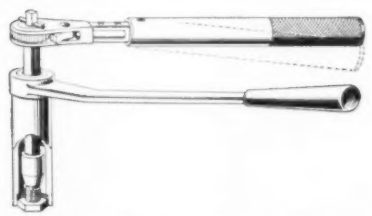
"Two-4-One" Cleaner-Polish

A new auto cleaner and polish, called "Two-4-One," is announced by the Du Pont Company's Specialties Sales section. It has been designed for use over all kinds of car paint, including "Lucite" acrylic lacquer, and is said to clean and polish in one easy operation.

(Use Reply Card for Further Information)

T-Bird Band Adjustment Wrench

A new "automatic" rear band adjustment wrench, designed to eliminate the possibility of visual error when working on the 1958 Thunderbird Cruise-O-Matic transmission, is



now available from Manzel—Division of Houdaille Industries, Inc.

The complete tool includes a torque limiting wrench with ratcheting head, which permits continuous turning in the restricted working area. A heavy-duty socket with bent handle is included, which tightens the locknut securely after set screw adjustment is made.

The wrench is pre-set... an audible sound and break in handle pull occurs when proper set screw torque is reached. Without removing the wrench, a flip of the ratchet enables the set screw to be backed off the required number of turns. A numbered indicator assures accurate control of back-off turns.

(Use Reply Card for Further Information)

Top-Side Mechanic's Creeper

The Top-Side Mechanic's Creeper being offered by Grigg Specialty Tools is designed to comfortably project the mechanic over the fenders of back-

opening hoods or the radiator of conventional front-opening hoods of cars and trucks, putting hard-to-reach parts and accessories, as well as fire wall mounted controls, within easy reach.

Made of heavy welded tubular construction, and said to last indefinitely, the creeper is easily maneuverable by means of three swivel creepers and adjustable to any desired working height. It is raised in six stages from a closed position of 40" to a fully extended height of 52". Safety features include non-tilt tripod construction, three mounting steps and hand rails.

(Use Reply Card for Further Information)

Ignition Tune-Up Kits

International Parts Corp. is now offering a counter display assortment of 24 ignition tune-up kits for cars,

trucks and tractors. The kits contain heavy-duty matched ventilated points, condenser and rotor, visually packed under acetate on individual cards; each card clearly marked with the model and cars the kit fits.

(Use Reply Card for Further Information)

Heavy Duty Brake Fluid

The Automotive Division of Wagner Electric Corp. announces a newly-developed Wagner Lockheed heavy duty brake fluid that is said to surpass SAE specification 70R1, and priced economically. Meanwhile, the popular Wagner Lockheed No. 21B Super Heavy Duty brake fluid, which surpasses SAE specification 70R1 and the proposed 70R3 specification, will continue to be marketed as Wagner's highest grade of brake fluid.

The new fluid will be readily identified by Wagner's familiar red, white and blue color combination on newly designed containers. It will be available in 12-ounce, quart, 1-gallon, 5-gallon, 30-gallon and 54-gallon drums.

(Use Reply Card for Further Information)

Frame Straightener

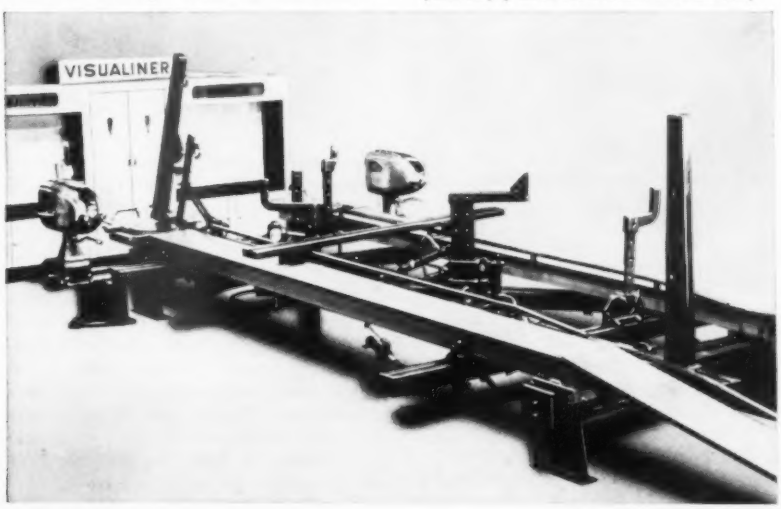
The new line of John Bean Frame Straighteners is said to provide complete equipment for all types of frame correction work, in addition to body press equipment for body correction operations.

Outstanding features of the equipment include especially designed tools that allow combination setups, thus reducing the total number of setups required for a given job. High tensile, alloy steel gives tools extreme strength while keeping them light in weight for easier handling. Friction-free roller carriages and rocker bars permit a full 20,000 lb. correction force to be applied to any point and at any angle on the frame or body.

Diagonal beams allow push and pull effort at any angle and also reduce the space required for the equipment. A full length rack is only 17 feet long.

The complete line includes standard floor and pit-type models that incorporate John Bean wheel aligners. Portable models are also available that can be used to supplement the regular equipment or as independent machines.

(Use Reply Card for Further Information)



Don't fall short of advance "know-what" on the '59 cars! Herb Carrier previews the Fall models in the September issue.

These are new *manufacturers' products*

License Plate Holder

A new Kwikee License Plate Holder is announced by Inland Mfg. Co. which is said to enable the auto owner to attach license plates easier and quicker than by any other method.

The Kwikee consists of three simple parts—a fastener with special groove

near the end . . . a slotted ring that locks into this groove . . . and a flat, shaped spring that not only holds the ring securely in place, but also holds the plate rigidly.

Installation is quick and easy . . . simply insert fastener through the holes in plate and plate-frame; place the spring over the fastener end and compress. Slip the slotted ring into the fastener groove, and release spring . . . and the job's done; in a matter of seconds with no nuts or bolts, no tools or skinned knuckles.

(Use Reply Card for Further Information)

Powerforged Piston

A brand new piston, manufactured by Thompson Products, Inc., through an exclusive new forging process, is said to offer an increase in strength of up to 70% over cast aluminum pistons without adding extra weight.

The new piston is known as Power-

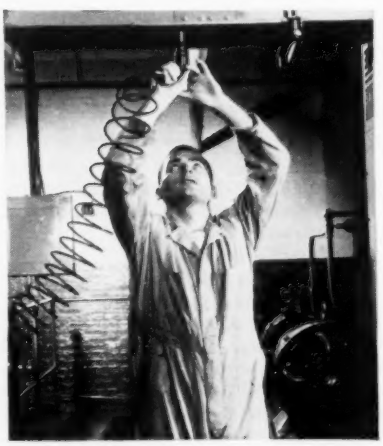
forged, and is made by forging aluminum slugs into piston forms with tremendous force, changing the grain flow and increasing strength by increasing the density of the aluminum.

The Powerforged Piston is the same weight as conventional pistons and will balance perfectly when used for replacement, yet is said to match the increased load and compression ratios of new, more powerful engines.

(Use Reply Card for Further Information)

Air Hose Has Recoil Action

A new lightweight nylon air hose for use with pneumatic tools incorporates snap-back action to keep it out of the way of work. Said to be tough, heat resistant and unaffected by oil, kerosene and gasoline, it is recommended as a general purpose



air hose for use around automotive repair shop.

Called Nycoil Hose, it is said to withstand high operation pressures as well or better than rubber hose; its abrasion and chemical resistance are superior and its smooth inside surface insures less resistance to air flow.

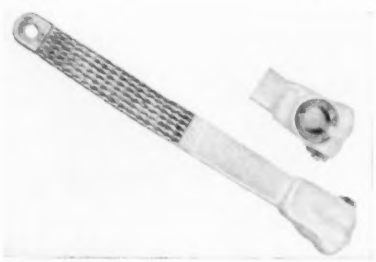
Nycoil is offered in 3/16" ID and ¼" ID sizes, in a standard 25-ft. length, with flare fittings on each end. If shorter lengths are desired, the hose may be easily cut and flared with a standard copper flaring tool.

(Use Reply Card for Further Information)

New Battery Cable

This new Wiry Joe "Fostercote" battery cable is described by the Crescent Co., Inc., as the "first really important battery cable development in fifty years."

The cable has a specially-developed coating that covers the terminal and a portion of the cable (or strap) leading to the terminal. This coating is said to be highly resistant to acids, alkalies, alcohols and oxidizing agents,



and according to the manufacturer, gives the battery cable a life 4 to 10 times longer than that of conventional cables.

(Use Reply Card for Further Information)

Boring Bar Angle Adapter Plate

A new line of Angle-Bore Adapter Plates for mounting any current make of cylinder boring bar in proper position to rebore and sleeve the new 10° Ford and 16.6° GM motor blocks is announced by the Rottler Boring Bar

Co., and available from Goodwin-Snader Co. The Model GMBP-1 is specifically designed for the GM series and the FBP-1 for the Ford series. Shown in the illustration is the Model FBP-1 in place on a Lincoln block.

Designed for light weight and ease in mounting, the adapter plates are cast of hi-tensile semi-steel and contain the necessary hole pattern for minimum changeover from one bore to another. Several tie-down provisions are incorporated in the design which permit usage in any shop or in-the-frame boring situation.

(Use Reply Card for Further Information)

Ignition-Actuated Tachometer

A new ignition-actuated universal tachometer utilizing modern transistors for easy and accurate rpm measurement on any gasoline engine has been announced by Fox Valley Instrument Co.

Operated by electro-static induction

and powered by four standard flashlight batteries, the new unit requires no electrical connections, and is said to respond accurately to engine speed whenever the single test lead is held in the vicinity of the ignition wiring—automobile engines can be tested simply by raising the hood and pointing test lead at ignition wiring.

The instrument has multiple ranges for engine speeds as high as 9,000 rpm and is calibrated for use on two-cycle engines having one, two, three, four or six cylinders and for four-cycle engines with one, two, three, four or six cylinders and for four-cycle engines with one, two, four, six, eight or twelve cylinders. It is reported to work equally well on magneto or battery ignition and on all system voltages.

(Use Reply Card for Further Information)

Hobart Shop Welder

A new low cost AC transformer type arc welder is announced by Hobart Brothers Co. which can be used for a variety of jobs around auto body and service shops, such as welding, cutting, hole-burning, hardsurfacing, soldering, brazing and heating metal for easy bending and forming.

Called the "Hustler," the unit is rated 180 amps. at 25 volts on 20% duty cycle. Operating voltage is 230 volts single phase, 60 cycles, with a tap provided for operating on the low 208 line voltage when such power voltage exists.

Welding and cutting current selection is easily made by plugging the electrode cable into one of nine receptacles arranged in a convenient circle on the output panel. The ground cable plugs into one of two receptacles in the center of the panel to provide a high or low range of welding current.

Standard equipment includes an electrode holder, plastic head shield, ground clamp, 20 ft. electrode cable, 15 ft. ground cable, 8 ft. power connecting cable and a liberal amount of welding electrodes.

(Use Reply Card for Further Information)

Air Powered Tire Changer

Coats Co. announces a new All-Star Model tire changer which offers "hands-free" bead loosening by means of a compressed-air cylinder that operates a cam-actuated bead loosener shoe. The operator merely presses a foot pedal.

Both tubeless and conventional tires—from 12" to 21" diameter—can be changed, regardless of wheel-type.

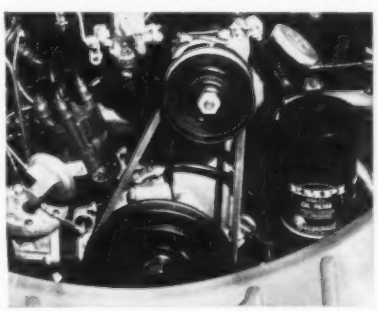
Another feature of the machine is the screw-type hold-down, called the easiest and most trouble-free hold-down ever designed—it assures positive locking with just a twist of the wrist.

Mounting and dismounting tools utilize polished rollers to eliminate any possibility of tire damage.

(Use Reply Card for Further Information)

Oil Filter for Volkswagens

Recently announced by European Motor Products, Inc., is a spin-on, spin-off oil filter expressly designed and engineered to fit all Volkswagen



models of the transporter and passenger lines.

The filter installs directly to the engine via a bracket, and its accessible placement allows quick changing of filter and permits removal of entire motor without disturbing filter or lines.

The filter kit comes complete with all fittings, high quality flex lines guaranteed against leakage and breakage, brackets, washers and a porosite oil filter cartridge with an aluminum case.

(Use Reply Card for Further Information)

Electric Fuel Pump Tester

Designed primarily as a test and demonstrator unit for Stewart-Warner's new 240 series electric fuel pump, this test stand can be used to test the shutoff pressure and delivery

of any electric fuel pump. In addition, fuel delivery to the carburetor—exact to the carburetor manufacturers' specified pressures—can also be tested with the unit.

The test stand can be used as a portable unit, or may be permanently fastened to a work bench. The unit is factory-assembled to include pressure gauge, shut-off valve, and quick, detachable couplings and fittings on the inlet and outlet hoses. It measures 15" high, 12" wide, with a base 12" x 7½".

(Use Reply Card for Further Information)

One Unit Heats or Cools

A new automotive heat pump has been developed by The Lo-Merc Corp. for converting their automobile air conditioners into a unit which is said to give *either heating or cooling* within ten seconds by a flick of the switch. The controlled hot air comes directly out of the air conditioning unit heated by the hot refrigeration gas from the compressor—not from the manifold heat or radiator water as in most present combination heaters.

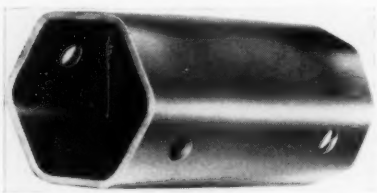
According to the manufacturer, the cost of the complete heat pump is less than the combined price of a standard air conditioner and conventional car heater. Also, it is said to take less space than the two units both in the car and under the hood.

(Use Reply Card for Further Information)

These are new *manufacturers' products*

Lock Nut Wrench

To facilitate the removal and replacement of the octagon or hexagon rear axle bearing lock nut used on



Ford truck rear axles, the Owatonna Tool Co. is now offering a newly designed set of rear axle bearing lock nut wrenches. The complete set consists of six sizes on four, 8½" long wrenches.

(Use Reply Card for Further Information)

Magnetic Particle Testing Unit

A completely re-engineered testing unit is announced by Magnaflux Corp. which employs the wet magnetic particle inspection method—either visible or fluorescent—and provides a rapid means for production testing of small ferrous parts up to 24" long.

The suspended magnetizing coil and

heads permit conveyorization of parts either through or across the unit. The coil, which pivots and slides along the overhead track, may be positioned between the heads for both longitudinal and circular magnetization of parts, moved to the right for separate coil magnetization, or stored to the extreme left when not in use.

In the illustration, inspection is being performed by placing the part between the heads or in the coil. As the magnetizing current is actuated, the part is flooded with a solution containing fine magnetic particles, either visible or fluorescent... the particles accumulating along any flaw, clearly marking all defective areas. Black Light reveals fluorescent particles as glowing indications.

Other features include: recessed front panel and 38" table height for sit-down operation; removable and reversible grills; infinitely variable current control; built-in line disconnect switch; and stainless steel tanks to accommodate either oil or the new water suspendible magnetic particle baths.

(Use Reply Card for Further Information)

Tubeless Tire Repair Rivets

According to A. Schrader's Son Division of Scovill Mfg. Co., all tubeless tire punctures up to ¼" in diameter can be permanently repaired with their new pull-through compression rivets—each with their own spe-

cial wire for quick, easy insertion into the puncture. In addition, use of the compression rivet is said to eliminate the need for preliminary buffing or scraping and the need for special tools.

The rivets are made of the purest gum rubber compounds so that a permanent repair job is assured. Three positive seals are created by the compression rivets: inside the tire, through the casing, and outside the tire. The head of the rivet also acts as a "stop" to prevent the rivet from being pulled all the way through and out of the puncture. The manufacturer further states that the rivets cannot be pulled through after the repair has been made, nor will they blow out or creep out, regardless of how rigorous are the driving conditions.

(Use Reply Card for Further Information)

Air Power Bead Breaker

Because the tighter beads on today's tubeless tires are difficult to break by hand, a new air powered doublebead breaker that attaches to any Bishman

Electric Power Tire Changer has been developed by the company.

A large air cylinder powers both upper and lower bead breakers, simultaneously or independently, with a long stroke that pushes both beads into the drop center. The air supply comes from any air hose which is applied to a valve in the handle. The wide circle shoes are said to be designed to prevent their slipping off the bead and to break the beads over 1/3 the way around the rim at one stroke.

(Use Reply Card for Further Information)

Double Receptacle Extensions

A new UL approved 3 conductor, double receptacle, extension cord for use with tools and equipment using the three pronged grounding plug, is announced by the Belden Mfg. Co.

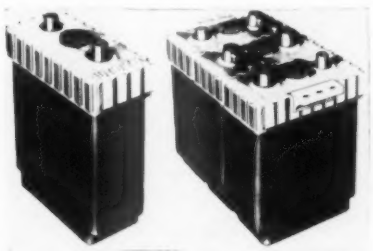
The new cord is 25' long and is

constructed with an unbreakable molded plastic three prong receptacle at the end of each of two 12" legs. The cord has three 16 AWG conductors with rubber insulation, and a specially constructed tuffer tred Neoprene jacket, which is said to be resistant to oil, grease, chemicals, moisture, abrasion, and impact.

(Use Reply Card for Further Information)

Battery Has Replaceable Cells

According to the Aut-O-Cel Company, approximately 96% of all battery replacements is due not to the failure of the battery, but to the failure of *only one cell* of the battery, which means that when an ordinary



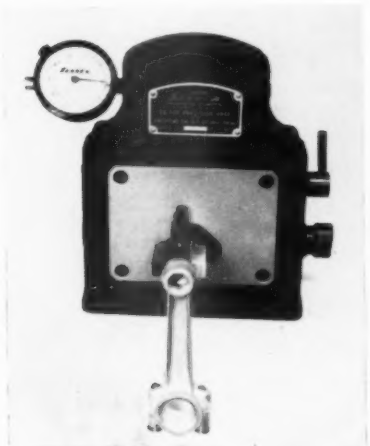
battery fails, the good cells must be wastefully discarded because all are in the same case.

To overcome this, the company is offering a new-type dry-charge battery featuring replaceable plastic cells (each cell guaranteed up to 40 months) which interlock to form batteries of any standard size, shape or voltage. In this manner, as individual cells fail, they are discarded and replaced with fresh Aut-O-Cel units, with the good cells remaining in service.

(Use Reply Card for Further Information)

Pin-Rod Fitting Gauge

A new small-range point set, designed for use on the Sunnen AG-300 Precision Pin Fitting and Rod Reconditioning Gauge, permits the mechanic to gauge holes as small as .375" in diameter. According to the



manufacturer, this gauge is said to be the only one that measures the actual pin fit clearance and interference by gauging the hole itself.

The AG-140 Small Range Point Set is especially recommended for gauging pin fits in foreign cars, other small engines, and wherever accurate gauging within the range of .375" to .720" diameter is required. The addition of this unit will enable the user to gauge holes in the entire diameter range of ⅜" to 3⅜". Measurements are read in "tenths" of thousandths on a dial.

(Use Reply Card for Further Information)

Oil Seal Tool Kit

A new tool kit is announced by Autocrafts Products Co. for gauging and installing front wheel oil seals. The kit consists of five double heads (ten sizes in all) and a plug-in type, driver. Each head consists of a metal core covered by a high impact resistant plastic skin, which is said to

provide desired dimensions as well as a smooth finish.

According to the manufacturer, used oil seals can be tested for wear and compared with new ones by inserting the gauge part of the head which approximates the size of the riding surface of the oil seal. The gauge also becomes a pilot for retaining and guiding the oil seal to facilitate installation. The driver plugs in on the reverse side and the seal can be installed correctly by applying pressure on the entire circumference, avoiding dents and distortion.

(Use Reply Card for Further Information)

6-12-volt Voltmeter

A new, easy-to-use voltmeter designed for quickly checking voltage on 6- or 12-volt cars, has been added to the line of automotive testing

equipment produced by the Fox Valley Instrument Co.

The new testing unit has a 0-16 volt range and is guaranteed accurate within two percent of full scale reading. It has two five-foot insulated leads, a large, easy-to-read meter and is built into an 8"x5"x2½" durable plastic case, equipped with rubber feet for resting the unit on the fender while testing. Simple operating instructions are printed on the back of the tester.

(Use Reply Card for Further Information)

Retaining Rings

A retaining ring kit containing 376 cadmium plated Truarc retaining rings with the various sizes packed individually in numbered envelopes,

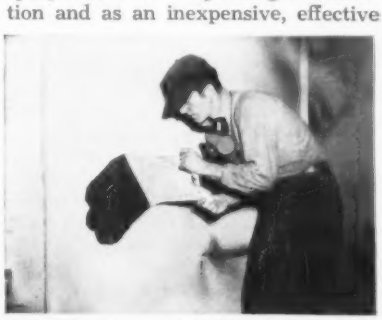
is now being offered by Bearings, Inc., to service internal or external shaft sizes from ¼" to 2½".

According to the manufacturer, sizes and designs in the kit represent approximately 70% of the retaining ring sizes now being used in industrial, automotive, aircraft and marine applications.

(Use Reply Card for Further Information)

Paint Booth Wall Protector

Magnus Strip Coat SC100 dries in minutes, forming a white opaque film which can later be peeled easily from the surface. It is widely used in paint spray booths for improving illumination and as an inexpensive, effective



method of removing overspray which accumulates on walls.

It is non-toxic, for it contains no chlorinated solvents, and has a solid content of 30%. It can be applied by spray or brush, covers 200-300 square feet per gallon and dries in 10 minutes. No thinner is needed when this material is applied by pressure spray.

(Use Reply Card for Further Information)

500 East 11th Street
Kansas City
Missouri

U. S. TRADE SCHOOLS

AUTOMOTIVE MECHANICS DIVISION

Transcript of Name: Ray L. Loyd
Home Address: 714 West Swope Parkway, Kansas City, Mo. Date Enrolled: 10-14-57
Date Completed: 6-13-58 No. Hours Up Graded: None
No. Tardies: 0 No. Full Days Absences: 0 No. Leaves: 0
FINAL EXAMINATION GRADE: 94% GENERAL RATING: S+

Part I	Introduction, Tools, Welding	48 Hours	S
Part II	Power Plant, Lubricating System Cooling System, Fuel System	240 Hours	S+
Part III	Power Train Including Automatic Transmissions	240 Hours	S+
Part IV	Chassis and Assemblies, Steering Gears, Wheels and Brakes	158 Hours	S
Part V	Electrical Systems	166 Hours	S+
Part VI	Engine Testing and Service	168 Hours	S+
	Total Instructional Hours	1020 Hours	

O - Outstanding S - Satisfactory U - Unsatisfactory

Mechanic Training . . . *(Continued from page 32)*

also have adequate equipmentation, comparable to any good shop anywhere, as well as specialized training areas for lab and basic study and diagnosis; and tools enough to supply the maximum permissible student body for each shift. Currently, the Diesel section has 21 operating engines, with five more expected to be acquired this year, special tools for the servicing of all major makes in the field, and of course, a completely equipped fuel pump room. Auto Body is provided with frame straightening and alignment machine; portable spray booth; a wealth of welding gear, and suction fans that can completely replace the shop atmosphere within one minute.

GEARED FOR THE JOB

U.S.T.S. proudly asserts that all its graduates are employable, otherwise they wouldn't be allowed to complete. The fact is that very complete records are kept of each student's progress and attendance up to the minute. No one graduates without completing all the work assigned to his course, unless he earns extra credit through up-grading exams on the basis of previous experience.

On the reverse side of every Diploma is this unusual "job argument": a brief of the graduate's school record. It shows the dates he enrolled and graduated; the number of hours, if any he was up-graded; the number of tardies, full days absences, and leaves; final examination grade, general rating. Below this information is the breakdown of the course, and the grade the student achieved in each part, as well as the number of hours devoted to the various subjects, and to the complete course.

It is this exceptionally-complete certificate of accomplishment toward which the U.S.T.S. students work from the time they enroll. How well it "goes over" in the automotive service field, is indicated in the school's post-graduate records, which are as complete as contact with industry and follow-up of the boys themselves permit.

Of those accounted for, better than 60% go into the automotive or diesel field; 15% have not entered the service field as far as the school's records show; while 20% return to farms and use their training on their own equipment. One out of five graduates goes to work for an independent garage or service station; 35% of the group goes to work for dealers; while 10%, one in every ten, open their own shops.

It was a proud moment for Alvin Janicek (left) when he received his well-earned Merit Award for Perfect Attendance at the hands of Melvin Ponick, U.S.T.S. assistant to the president. While working eight hours a day, Janicek attended Auto Diesel five nights a week for 43 weeks without being tardy or absent. At right above, the revealing condensed school record that appears on the reverse side of every Diploma. All students are urged to make that record a "sales appeal" to prospective employers by scoring high in conduct, assignments, attendance.

Meanwhile, U. S. Trade Schools itself prepares to mark another milestone as it bends every effort to keeping pace with the service field. Within the next few months, it will occupy new quarters, 50,000 square feet of floor space . . . a three-floor cement and brick structure. There'll be soundproof classrooms, expanded shop areas, improved ventilating and lighting, even new subjects, such as Shop Foremanship.

The faculty will go about its business of "minding the store" for the automotive service industry. It knows that the "live" work it stresses so heavily creates an extra load in job scheduling, purchasing and customer handling. But all the headaches involved are believed to be far outweighed by the benefits that the students receive through this continual emphasis on the trade in their training days.

Before Adding Battery "Dopes" Check Battery Maker's Guarantee

A warning has been issued by the Association of American Battery Manufacturers that a battery manufacturer's guarantee should be checked before adding "dopes" or special electrolytes to batteries.

According to the recommended Domestic Marketing Standards of the Association: "The addition of any chemical or solution other than approved water or battery grade sulphuric acid of proper specific gravity voids the guarantee."

Do you TELL — or can you SELL — your customers what's needed? September's installment of "So you want to open a service shop" takes up "Salesmanship," and gets down to cases on meeting objections!

• • •

Whatever Your Needs in Parts... Tools... Equipment...

ASD's NEW ... Reader Service Department is designed to serve your needs.

If you should desire further information and literature about the items described in our "These Are New Products" pages ...

Simply check the items you are interested in on the handy postage-paid business reply card, fill it out and mail it to us.

Information will be sent to you direct from the various manufacturers.

•

A Subscription Order Form is also attached for your convenience—or pass it along to a friend.

• • •

Make sure all the items you want to know more about are checked ... also check to make sure your name, organization and address are correctly printed on the post card ... THEN mail it today without delay.

•

Please Send Me More Information and Literature About Items Checked Below: 8-58

☐ End Lift Jack	☐ Ignition-Actuated Tachometer	☐ Lock Nut Wrench
☐ Tune-Up Book Revised	☐ Hobart Shop Welder	☐ Magnetic Particle Testing Unit
☐ Heavy-Duty Axle Press	☐ Air Powered Tire Changer	☐ Tubeless Tire Repair Rivets
☐ Ditzler Adds Brushes to Line	☐ Oil Filter for Volkswagens	☐ Air Power Bead Breaker
☐ "Two-i-One" Cleaner-Polish	☐ Electric Fuel Pump Tester	☐ Double Receptacle Extensions
☐ T-Bird Band Adjustment Wrench	☐ One Unit Heats or Cools	☐ Battery Has Replaceable Cells
☐ Frame Straightener	☐ License Plate Holder	☐ Pin-Rod Fitting Gauge
☐ Top-Side Mechanic's Creeper	☐ Powerforged Piston	☐ Oil Seal Tool Kit
☐ Ignition Tune-Up Kits	☐ Air Hose Has Recoil Action	☐ 6-12 Volt Voltmeter
☐ Heavy Duty Brake Fluid	☐ New Battery Cable	☐ Retaining Rings
	☐ Boring Bar Angle Adapter Plate	☐ Paint Booth Wall Protector

In addition, send information on the Advertised Products appearing on pages:

_____, _____, _____, _____, _____, _____, _____, _____, Cover ____, ____, ____

(THIS CARD WILL BE HONORED UNTIL NOV. 15, 1958)

FIRM NAME.....

ADDRESS.....

CITY..... ZONE..... STATE.....

YOUR NAME..... POSITION.....

☐ Repair Shop ☐ Dealer ☐ Fleet Operator ☐ Other: .....

SUBSCRIPTION ORDER FORM 8-58

TO AUTOMOTIVE SERVICE DIGEST
900 SO. WABASH AVE., CHICAGO 5, ILL.

☐ 1 year $4.00 ☐ New ☐ Renewal
☐ 2 years $6.00 ☐ Check Enclosed ☐ C.O.D.

SEE PAGE 69 FOR SPECIAL OFFER ON NEW SERVICE MASTER MANUALS.

NAME.....

ADDRESS.....

CITY..... ZONE..... STATE.....

Please Check Kind of Business:
☐ New Car or Truck Dealer ☐ Fleet Operator
☐ Auto Repair and Service ☐ Service Station
☐ Automotive Jobber
☐ Other Than Above.....

Ordered By ..... SIGNATURE ..... Title or Position.....

(Above rates good only in United States and Canada)

FIRST CLASS
PERMIT No. 1329
Chicago, Illinois

BUSINESS REPLY CARD
No Postage Stamp Necessary If Mailed in United States

POSTAGE WILL BE PAID BY—

AUTOMOTIVE SERVICE DIGEST

900 South Wabash Avenue

Chicago 5, Illinois

FIRST CLASS
PERMIT No. 1329
Chicago, Illinois

BUSINESS REPLY CARD
No Postage Stamp Necessary If Mailed in United States

POSTAGE WILL BE PAID BY—

AUTOMOTIVE SERVICE DIGEST

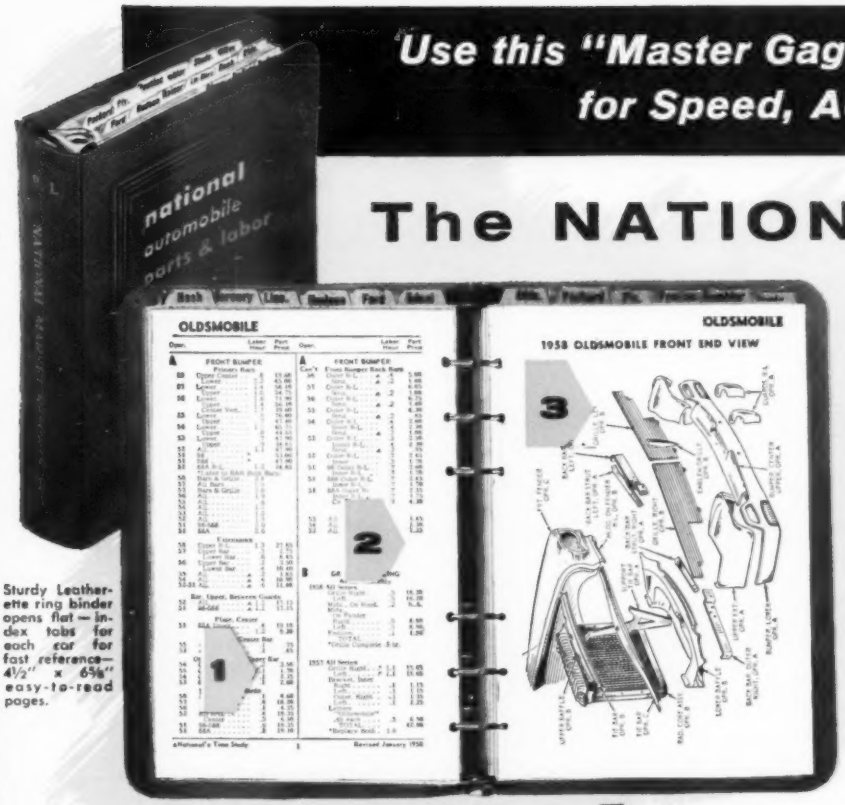
900 South Wabash Avenue

Chicago 5, Illinois

Use this "Master Gage" for Speed, Accuracy, Profit

The NATIONAL AUTO PARTS & LABOR MANUAL

The 3-in-1 master service



Sturdy Leatherette ring binder opens flat — index tabs for each car for fast reference — 4½" x 6⅝" easy-to-read pages.

Most Complete Service at the Lowest Cost $16.50

With this "master gage," you have *a precise check* on parts prices and labor charges — no guessing, no waste of time with catalogs and mathematics. For just $16.50 you have National's P & L Manual always at hand — the latest figures, illustrations, exploded views, including complete up-to-the-minute replacement-revision service that normally totals 15 mailings of more than 1300 pages annually.

Now! Separate Sections for Collision and Mechanical

For easier-to-use reference, National's P & L Manual is divided into two "fast find it" sections: (1) *Collision Section*—with all operations arranged in logical sequence. (2) *Chassis Mechanical Section*—covering all other repair services.

More than 50,000 Users

Year after year, in excess of 50,000 shops, garages, dealers and insurance adjusters subscribe for and rely upon National's P & L Manual. This nationally recognized "master gage" is their dependable authority for precise estimating and billing — and it is kept up-to-date constantly.

So if you want to be sure of *profits in your service and repair departments — in your body shop* — subscribe now for National's quick-reference, dependable P & L Manual. Complete satisfaction is guaranteed.

NATIONAL MARKET REPORTS, INC.
900 S. Wabash Ave., Chicago 5, Ill.
AUTOMOTIVE PUBLICATION SERVICES SINCE 1911

1 LABOR CHARGES

*Official factory time studies** expressed in hours and tenths, automatically figured at your hourly rate. No arithmetic — no chance for error. Covers all domestic cars.

2 PARTS PRICES

Factory list prices in the separate Chassis Mechanical Section cover all current makes, all models for the past 8 years — hardtops, convertibles and station wagons included.

3 ILLUSTRATIONS

For faster body shop estimating and billing, the separate Collision Section shows exploded views of front and rear suspensions, grilles, power steering — front sheet metal, including sub-assemblies and bumper — body diagrams, indexed by make.

* Where no factory flat rate exists symbol ▲ indicates that labor hours are based on National's field survey.

MAIL YOUR ORDER TODAY — 30-DAY MONEY-BACK GUARANTEE

NATIONAL MARKET REPORTS, INC., 900 S. WABASH AVE., CHICAGO 5, ILL.

Please enter our order for 1-year's service as indicated below, subject to your 30-Day free trial guarantee on National's P & L Manual:

Rates for United States and Canada only (Quantity Rates on Request)

- ☐ National Auto Parts & Labor Manual, Master Edition, including year's revision service $16.50
- ☐ Automotive Service Digest, one year—the country's foremost monthly magazine of shop know-how ..... $ 4.00
- ☐ (in combination with P & L Manual) ..... $ 3.50

☐ Check encl. ☐ We'll pay postman on delivery (plus charges)

Firm Name _____

Street Address _____

City _____ Zone _____ State _____

AD.

Announce 4-cylinder automotive diesel

High-speed unit offered as replacement engine for cars and trucks, features new-type combustion system and other design innovations. Six years in the development, it boasts an impressive record of experimental successes.

• AN AUTOMOTIVE powerplant combining the might and economy of the diesel with the speed and flexibility of the gasoline engine, is at last achieved in the new "Four 99" now available for test, according to the manufacturer, F. Perkins (Canada) Ltd.

Offered in special conversion engine sets to replace gasoline units in the Ford Consul, Vauxhall Velox and Wyvern cars, and Bedford, Austin and Morris trucks, the 99 cu.in. model is described as a "revolutionary, small four-cylinder, high-speed diesel." Behind it are one million miles of road tests since development began in 1952, and some impressive reports.

The Four 99 has been used, from the Arctic to the tropics, in the Vauxhall Velox and Wyvern, Morris Oxford, Simca Versailles, Mercedes 180D, Ford Consul and Simca Airiane cars. Also in Beardmore Mark 7 taxis, and the Bedford C.A., Austin Omnivan, Standard delivery and Austin A70 utility trucks.

TEST RESULTS

In official tests conducted by the British Royal Automobile Club, the diesel engine is reported to have shown outstanding economy as well as sufficient capacity for speed to meet normal driving needs. Cruising and top speeds have equalled those of similar cars equipped with gas engines, with the Four 99 getting better than 80 m.p.h. in some cases.

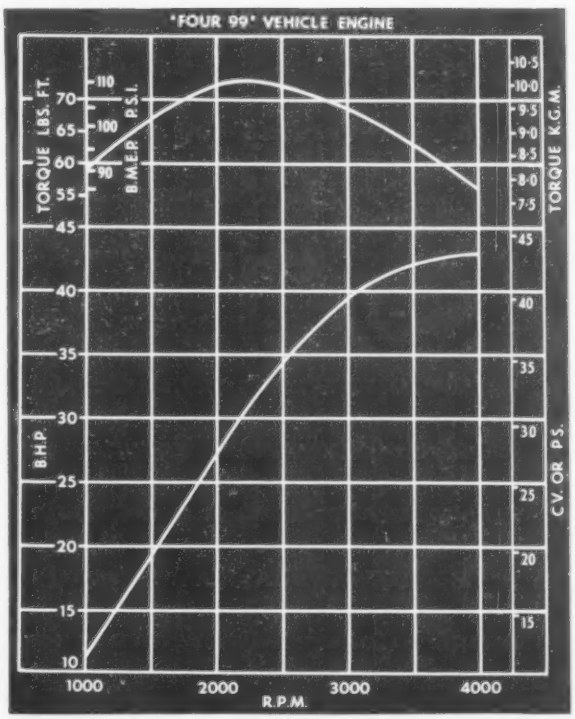
At an average speed of 34.8 m.p.h., a Vauxhall Velox averaged 56.6 miles per gallon of fuel; while a Ford Consul made 50.8 miles per gallon at an average speed of 34.7. Lapping consistently at 56 m.p.h., a Bedford truck carrying 15 cwt. did 101,202 miles on the high speed track of the Motor Industry's Research Association test ground at Lindley; average fuel consumption was one gallon per 37 miles.

Last year a Four 99 engine completed 3,000 hours of continuous operation at 3,000 r.p.m. under full load in the test shop. When stripped, it revealed pintle-type injector nozzles still perfectly serviceable, after the equivalent of 90,000 road miles. This type of durability in the engine was also evidenced in one road test unit torn down after 100,000 miles, according to the Perkins firm: examination showed all major components in excellent condition.

Perkins Ltd. reports that the diesel engine's test history emphasizes long life under the most exacting operating conditions. The rate of bore wear averages only .001" per 20,000 miles.

APPLICATION FEATURES

Since it eliminates the principal objections that motorists have had to the diesel engine, the Perkins development is expected to be particularly interesting to the private car owner, and the fleet operator. It is compact and light—weighs 342 lb. with generator and starter (less flywheel and starter ring or housing). The car version



develops 43 b.h.p. at 4,000 r.p.m.; the truck type, 42 at 3,600. An industrial model, also available develops 32-35 b.h.p. at 3,000; and can be supplied with a pedestal mounting.

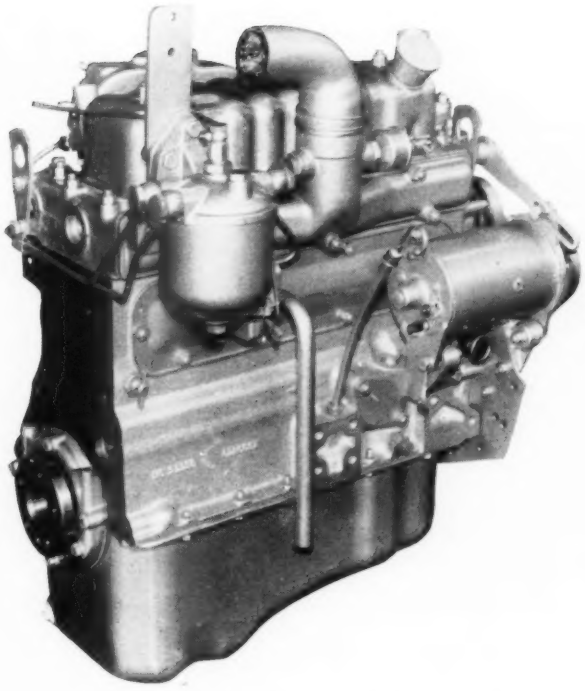
The Four 99 has push-button starting, and a built-in heater in the intake manifold to facilitate cold-weather starting. It is equipped with a 12-volt electrical system.

DESIGN INNOVATIONS

Development of the new diesel has been made possible, according to its manufacturer, by important advances in bearing design; the introduction of a rotary-type fuel pump to permit higher engine speed, and a new, patented combustion system.

Described as permitting better performance through the wide speed range, without smoke, the combustion system was specifically designed for the smaller size cylinders of the Four 99. The upper part of the combustion chamber is hemispherical and is machined into the cylinder head; the lower half is formed by a machined plug insert, which contains the throat connecting the chamber to the cylinder.

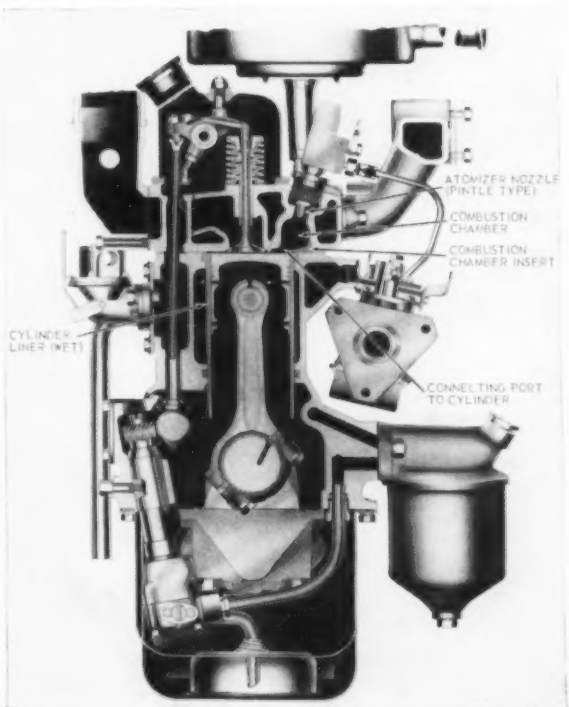
During the greater part of the compression stroke, air



is forced upward vertically through the oval port, producing swirl as it moves transversely across the pintle-type fuel injection nozzle. As compression proceeds, the direction of the air is gradually changed from the vertical to the horizontal. The final part of the air is forced violently into the combustion chamber in a horizontal direction, just as combustion is about to begin, producing considerable turbulence in the mixture of air and fuel already present. By this means, it is claimed, more complete combustion is obtained, and the maximum quantity of air is utilized.

Performance and construction details of the new automotive diesel engine are shown in the accompanying illustrations. The Four 99 has a 3" bore, 3½" stroke, nominal compression ratio of 20:1; maximum torque of 73 lbs.ft. at 2,250 r.p.m.

Cross-sectional views of the Four 99. Wet liners are of centrifugally cast iron, sealed by synthetic rubber ring at bottom.



New electrical team from Delco

By HERB CARRIER
Detroit Editor

• WITH THE USE OF electrical energy for powering vital vehicle components and ever-increasing accessories apparently at the saturation point, the announcement of an entirely new alternating current generator is bound to stir up a good deal of comment among automobile men. Especially when the generator is about 16 pounds lighter in weight than its heavy-duty direct current counterpart, and when it requires no external rectifying unit! Also, to make the news more interesting, the new voltage regulator designed for use with the a.c. generator is transistor powered and has no moving parts!

Such is the case with Delco-Remy's new alternating current generator and electronic voltage regulator. The many advantages of this unique power producing team may be more than enough to cause its use as original equipment on future passenger cars; rather than the now in use, but limited performance, direct current generator.

PRESENT UNITS HANDICAPPED

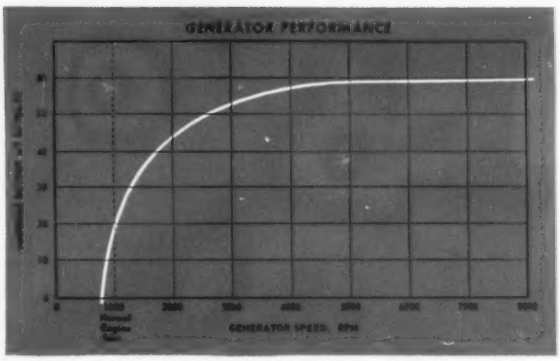
At the present time all standard passenger cars use direct current generators. Because of basic design, the armature of a d.c. generator must be driven at considerable r.p.m. in order for it to put out anywhere near its peak amperage. This is a definite handicap because of the thousands of miles the average car is driven in slow moving city traffic, and the constant drain of ignition, lighting, radio, air conditioning, etc.

An alternating current generator, by definition, is one in which the field—rather than the armature—rotates. This design inherently will put out a relatively high percent of its maximum output at low r.p.m. In fact, Delco rates its a.c. generator output at 26 amperes at engine idle, and up to 60 amperes at higher engine speeds.

Alternating current generators have proved their advantages on special installation vehicles for several years. As used, their major disadvantages are bulk and cost. Current a.c. units require external rectifiers, which add to over-all mass, and are quite expensive to buy and to install.

According to Delco engineers, their units will:

1. Have ability to deliver the electrical requirements of power operated accessories even at slow city traffic speeds.



2. Eliminate the need for periodic regulator adjustments.
3. Contribute importantly to greater storage battery life.
4. Insure longer life for generator brushes.

The self-rectifying feature of the a.c. unit is accomplished by the use of specially designed silicon diodes which are built into the end frame of the generator. Because no wires are needed to service this rectifier, the generator can be easily installed with a minimum modification to the standard d.c. electrical system.

UNAFFECTED BY ELEMENTS

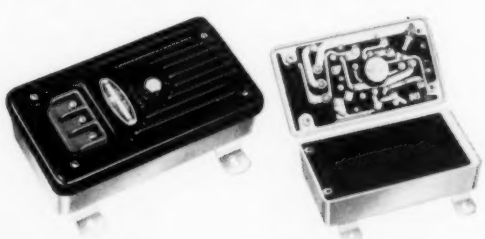
The electronic regulator uses no springs, hangers, or contacts. Consequently, it defies the usual adverse affects of temperature and humidity, and loss of voltage control because of excessive vibration of the mounting site.

Delco-Remy in announcing the new generator-regulator power team cited it as "one of the major advances in the automotive electrical equipment field in the last quarter of a century," and predicted that its inherent advantages over present units will become firmly established as the requirements of the automotive electrical systems become more exacting.

The new assembly will be available during the last quarter of 1958, and is expected to go into immediate use on special service vehicles such as police cars, taxi cabs, delivery cars and light trucks.

Delco-Remy's new alterating-current generator can put out 26 amperes at engine idle, and has maximum output of 60 amperes. It is 5¾ inches in diameter, weighs about 31 pounds. Six silicon rectifiers, built into the slip ring end frame, eliminate need for external rectifiers or wiring.

Transistor-powered voltage regulator has standard overall and mounting dimensions; no moving parts; operates safely in up to 160°F under-hood heat.



YOUR CHOICE OF ANY THREE FREE!

NEW SERVICE MASTER MANUALS

Ready reference tools to improve technical know-how, efficiency and increase automotive service profits.

Each Service Master Manual covers a major service category—clearly illustrated—easy-to-understand with supporting charts, graphs and diagrams. Unequaled as a source of ready information.

You have your choice of any three manuals FREE with your three-year subscription to AUTOMOTIVE SERVICE DIGEST.

CHOOSE FROM THE FOLLOWING SERVICE MASTER MANUALS:

No. 1. Brake Systems

No. 1. BRAKE SYSTEMS. The complete step-by-step service story of brakes through conventional, vacuum-power, air hydraulic, and straight air types. It gives you a thorough knowledge of what brakes are and how, and why they work.

No. 2. Trouble-Shooting Instruments

No. 2. TROUBLE-SHOOTING INSTRUMENTS. Covering all important instruments, including oscilloscopes, used in connection with testing, diagnosis and tune-up operations. Each instrument is thoroughly covered individually to show how it works . . . how it is connected to get different readings . . . how these readings should be used . . . plus specific examples of problem solving.

No. 3. Ignition System Servicing

No. 3. IGNITION SYSTEM SERVICING. Explains the basic principles, theory and application of the primary and secondary circuits, breaker point and distributor operation, testing and servicing. Covers the function of the generator, coil, condenser and how they are related in the ignition system from battery to spark plugs. Detailed tuning and adjusting principles and service of magnetos.

No. 4. Servicing Automatic Transmissions

No. 4. SERVICING AUTOMATIC TRANSMISSIONS. The basic principles of operation . . . fluid couplings . . . torque converters . . . servo mechanisms . . planetary gears . . . throttle linkage adjustments . . . in-the-car service testing and corrections . . . band adjusting procedure. Covers the operation and service of Hydra-Matic, Powerglide, Fordomatic, Powerflite, Dynaflow, Powermatic and Flash-O-Matic.

MANUALS AVAILABLE ONLY WITH SUBSCRIPTION ORDER

Current subscribers to AUTOMOTIVE SERVICE DIGEST may extend their present subscription to obtain the free manuals.

Additional Manuals available only with subscription order. Sorry, this offer is not retroactive.

AUTOMOTIVE SERVICE DIGEST, 900 S. WABASH AVENUE, CHICAGO 5, ILL.

Please enter my subscription as indicated. I am to receive a FREE manual for each subscription year.

- ☐ 3 Year Subscription $8.00 (Choose any three manuals FREE)
- ☐ 2 Year Subscription $6.00 (Choose any two manuals FREE)
- ☐ 1 Year Subscription $4.00 (Choose any one manual FREE)

INDICATE FREE MANUAL CHOICE

☐ No. 1. Brake Systems ☐ No. 2. Trouble-Shooting Instruments ☐ No. 3. Ignition System Servicing

☐ Additional @ 50c each ☐ Additional @ 75c each ☐ Additional @ 50c each

☐ No. 4. Servicing Automatic Transmissions — ☐ Additional @ 75c each

Name..... Title.....

Firm Name .....

Street Address .....

City ..... Zone..... State.....

Please Check Kind of Business:

☐ New Car or Truck Dealer ☐ Auto Repair and Service

☐ Automotive Jobber ☐ Fleet Owner ☐ Other .....

A-A

ORDER YOUR FREE MANUALS TODAY!

Automotive Clinic . . .

(Continued from page 6)

which can damage both pistons and valves when the engine is under load. On the piston illustrated, not only was the hole broken in the piston head, but the rings were actually baked into position so they could not be moved; and the piston pin was so tight that with the piston held in a large vise, a powerful mechanic was unable to move the rod.

To illustrate the meaning of the term "hammer-like blows," look at

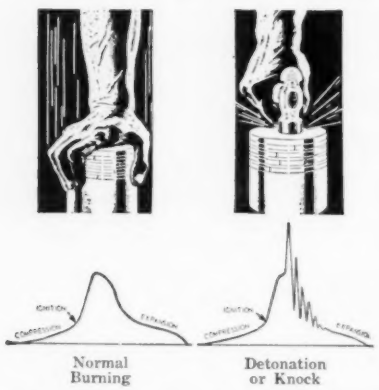


Fig. 2. Diagram illustrating the pressure curve when there is normal ignition and (at right) when there is detonation or knock. Detonation can cause hammer-like blows which may seriously damage pistons.

the typical time-pressure indicator diagrams of combustion that are shown. Normal progressive burning of the fuel-air charge is shown at the left; on the right, knocking in the cylinder as the end portion of the charge explodes or detonates, creating high-frequency, high-pressure shock waves in the cylinder. Damage to spark plug insulators and electrodes may occur in addition to damage to valves and pistons.

Unless late model, high-compression engines are kept properly tuned, and run on the recommended fuel, detonation and damage can be a very real problem to car owners.

Checking Field Windings

In your recent article on trouble shooting the starting system (June, 1958, p. 34), you state that field windings are checked with a test light by touching one prod to the motor frame and the other to the end of the field winding, being sure that neither of the grounded brushes is touching any grounded metal.

I am of the opinion that it should read, ". . . neither of the *insulated* brushes touching any grounded metal," as I never check one until after I take it apart.—*J.J.S., Pineville, Ky.*

Answer: Our statement is correct, but might have been a little clearer if we would have said that none of the brushes should be touching any grounded metal while making this test.

With the ground brushes not touching any grounded metal, and then touching the test prods to the frame of the motor and to the normally insulated ends of the field coils will cause the test light to light up IF there is a ground in the coils. If the coils are properly insulated, the test lamp will NOT light up.

Points Keep Burning Out

In the past six months, a customer's 1955 Chevrolet (6-cylinder, 12-volt system) has burned out 12 sets of ignition contact points. The car has been checked by five different shops, and nothing has been found which would be responsible for this condition.

I personally have checked the voltage regulator, coil, condenser, ignition switch, as well as all ignition connections. No oil is evident in the distributor to cause trouble, and the coil balance resistor has been changed twice.

I know there is something wrong somewhere, but evidently the trouble is intermittent. Inasmuch as this job has been checked by some top notch tune-up men I don't mind admitting defeat . . . but can you give me the most common cause of this condition so that I can lick it?—*J.B.F., Fall River, Mass.*

Answer: There are only two basic reasons why breaker points burn out: (1) Excessive current going through the points, and (2) oil or grease in the distributor, which causes the points to oxidize and fail.

The first thing that occurs to us is that the by-pass circuit, which is supposed to cut out the series ballast resistor only while the cranking motor is operating, may be cutting out the resistor at other times or all the time. This would allow full battery voltage to go through the coil with resultant extreme amperage. Check the amperes with the engine running at idle—amps should not exceed 2 to 2.5. Also check the voltage, which should be about 9 at the coil (resistor side).

WHEN CHANGING YOUR ADDRESS

Please notify us 5 weeks in advance. Supply us with both your old and new address, including address label from current issue if possible. Copies we mail to your old address will not be delivered by the Post Office unless you pay them extra postage. **Mail address changes to Circulation Dept., Automotive Service Digest, 900 South Wabash Ave., Chicago 5, Ill.**

If this should prove to be okay, then check the controlled generator voltage —which should not exceed 15.0 to 15.2. Be sure the points are correctly aligned and that the dwell is within specs . . . and be sure there is no excess play in the breaker plate.

Mysterious "Thump"

I am having trouble locating a thumping noise in a 1949 Chevrolet which occurs every time the car goes over a bump which makes the body rock. I don't get the noise when the wheels hit a rough spot—only when the body rocks; and only on the road, not in the shop.

I've had the U-joints apart, checked transmission mount, shocks and everything else I can think of.—*D.D.A., Litchfield, Conn.*

Answer: Noises such as this are very elusive and frequently sound as if they are coming from a point that is far from the actual source.

One thing to do is to have a passenger ride in the back seat and listen for the noise, trying to locate where it originates. You might check the body bolts, the sway bar or stabilizer, the upper and lower control arms, the steering gear box and spring shackles.

Another thing that could possibly cause the noise would be a loose flywheel. Also, check the ball joint on the front end of the torque tube, as well as the seat anchors; if any of the seat bolts are loose it might cause the noise you describe. Did you check the spare tire anchor in the trunk of the car?

Noisy Valve Lifters

One of our customers has a 1956 Studebaker Golden Hawk with ten thousand miles on it which has developed noisy hydraulic valve lifters when driven at speeds lower than 30 m.p.h. At speeds over 40 m.p.h., the tappets are quiet. Oil pressure is good at all engine speeds, and the owner has always used a top grade 10-30 oil.

Is this trouble due to the lifters themselves, or is it due to sticking valves?—*R.A.L., Muscatine, Iowa.*

Answer: The article, *Servicing Hydraulic Valve Lifters,* which appeared in the February, 1958 issue of AUTOMOTIVE SERVICE DIGEST (p. 40) is enclosed herewith, which we believe will contain the answer to your problem.

As long as all the lifters act the same way, the trouble would appear to be in the oil supply, perhaps an obstruction in the supply passage or tube leading to the lifter housings.

One method of cleaning out gum or varnish accumulations is to put 8

ounces of Butyl Cellosolve, 1 quart of engine oil and four quarts of kerosene in the oil pan after draining out the old oil, and run the engine at a fast idle for an hour (out of doors). Then drain and replace with clean oil of the right grade. The Butyl Cellosolve can be obtained from any chemical supply house.

Of course, it is possible that all lifters are worn to the point where their leakdown rate is excessive and only operation at high speed will supply enough oil to keep them quiet. You can quickly check leakdown rate by pressing on one of the rocker arms with a hammer handle to see how fast the lifter can be bottomed—which should take at least fifteen seconds.

Why Dual Breaker Points?

Could you please set me straight on the function of the double breaker points used on some of the Chrysler built cars, as well as tell me why they are used?—*D.E.B., Silas, Ala.*

Answer: On the distributor you ask about, one of the points opens slightly later than the other, which means that the first point to close *makes* the ignition circuit, or *closes* it. When the second point closes, it has no effect, because the first point has already closed the circuit. When the first point opens, it has no effect because the second point continues to close the circuit, but when the second point opens, the ignition circuit is broken. Therefore, *the first point closes the circuit and the second point opens the circuit.*

The purpose of this arrangement is to obtain a little greater dwell and still have a suitable breaker point gap. When setting the point gap, both are set to the same specification, and when timing the ignition the same procedure is followed as when timing an engine with only a single set of points.

"Granted, Ali has some strange customs, but he's a cracker jack mechanic!"

(NOW PELLETIZED)

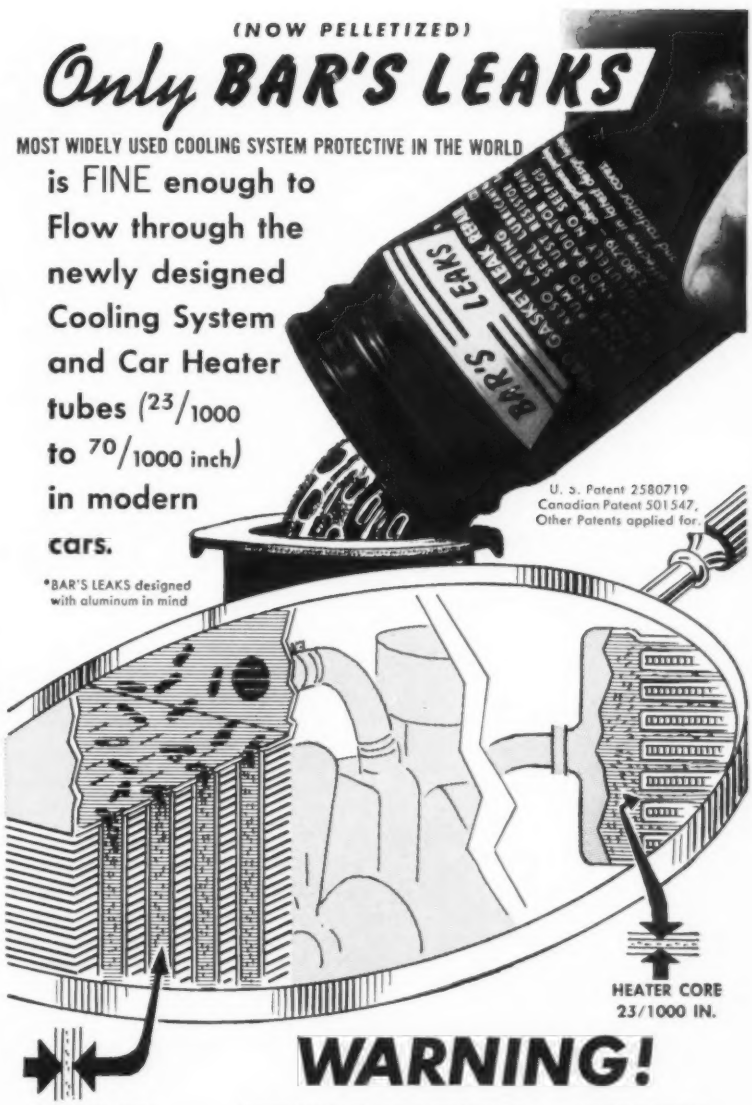
Only BAR'S LEAKS

MOST WIDELY USED COOLING SYSTEM PROTECTIVE IN THE WORLD

is FINE enough to Flow through the newly designed Cooling System and Car Heater tubes (23/1000 to 70/1000 inch) in modern cars.

*BAR'S LEAKS designed with aluminum in mind

U. S. Patent 2580719
Canadian Patent 501547.
Other Patents applied for.



WARNING!

SERVICE STATIONS — DEALERS

Only BAR'S LEAKS meets the cooling system specifications of every automobile manufacturer as to fineness of ingredients and required protection.

Be on the alert! Many other sealer inhibitors contain coarse, bulky material. They clog the tiny new-car tubes of radiators and car heaters (23/1000 to 70/1000 inch). Fail to circulate. Fail to protect. As a result, aluminum components become pitted, harmful rust and scale develop, and seepage endangers vital metal parts. Remember, if you ruin a car, you're responsible.

Improved BAR'S LEAKS, now pelletized, dissolves to particles 15/1000 inch and smaller. BAR'S LEAKS circulates freely through the smallest heater and radiator cores. Only BAR'S LEAKS provides the required protection — inhibits rust and scale — seals all leaks in gaskets and porous metal. BAR'S is a *MUST!* Write for literature. Tells how you can qualify as a certified cooling system expert.

Cash in on BAR'S for a lucrative repeat business. LIST PRICE $1.00
Available through automotive jobbers, service stations, auto goods stores.

BAR'S PRODUCTS SUPPLY, INC.
(Office and Plant) P. O. BOX 146 • HOLLY, MICHIGAN

Balancing . . . *(Continued from page 23)*

expensive is a standard bench drill stand equipped with a standard ½" electric drill suspended from an overhang track on a suspension balancer or spring. The cranks can be drilled by hand with a portable drill but without the advantage of sufficient leverage the operation becomes time consuming.

With the exception of the bob weights and their application to the con rod journals previously mentioned, the setting up and balancing of a V-8 engine crank is similar to that of the 6-cylinder crankshaft.

SINGLE PLANE BALANCING

Setting up a workpiece, flywheel for example, for single plane balancing is much the same as with two-plane balancing. The principle difference is that the recording mechanism of the right hand work support only is used (Fig. 3). The left hand work support is either disengaged or locked out.

The crank-flywheel and crank-flywheel-clutch assembly can be balanced in assembly by the single plane method. Special adapters which insure balancing accuracy and alignment are available for this.

After the crank has been two-plane balanced, the left hand stationary work support is moved into position under the self-aligning bearing which has been placed on a combination adapter. The cap is placed over the bearing and locked down with a wing nut using finger pressure only.

Next the machine rollers of the left hand work support are released from contact with the front main bearing journal. With the machine set up this way the crankshaft becomes the master arbor or mandrel. The flywheel is mounted on the flange end of the crank. When the crank-flywheel and clutch are balanced in assembly, the same speed (520 r.p.m.) is used as for balancing the crank separately.

After balancing, the flywheel is corrected by drilling, using same radius as that used by the original manufacturer. When the flywheel has been corrected, the clutch (less disc or plate) is added to the flywheel and balanced similarly by the method used for the flywheel.

Clutches are generally corrected by drilling into the pressure plate at the bottom of the spring bores. The mechanic should check for previous drilling. When the crank-flywheel and crank-flywheel-clutch (in assembly) have been balanced and corrected, the result is not only a balanced group as a unit, but each component is balanced independently and may be used as such. A good plan is to paint a yellow stripe across each of the three parts so they will be matched correctly when reassembled in the engine.

The diameter and weight of a part governs to a large extent the balancing speed. Typical examples are:

Part	*Diameter (In.)*	*Weight (lbs.)*	*Operating Speed (r.p.m.)*	*Balancing Speed (r.p.m.)*
Flywheel	10"	25	400	520
V-Pulley	6"	5	1750	1140
Fan	12"	1	1750	1520
Pump Impeller	4"	3	3600	1520

The maker of the equipment illustrated in this article states that satisfactory balancing of parts will result if the following points are adhered to:

- A well installed machine, on a husky foundation (like a scrapped planer or lathe bed) away from intermittently operating heavy equipment.
- A slip fit relationship between the bore of the driving adapter and the arbor or shaft of the part being balanced.
- A machining tolerance of .001" total indicator run-out on the arbor or shaft of the part being balanced. And, the arbor or shaft be turned and ground on centers.
- Driving from the end of the arbor or shaft having the shortest shaft extension.
- If using an arbor—the latter be balanced before attempting to balance any parts.
- A contact breaker point gap setting equivalent to a tight .002".

There is, of course, much more to single and double-plant balancing than given in this article. Space limitations does not permit presenting all the possible set-ups and balancing processes possible with a machine of this kind. Complete instruction and field help is furnished by the manufacturer.

(Photos, courtesy Bear Mfg. Co., Rock Island, Ill.)

Beware of Steam

If a customer drives into your shop with a new car, be especially careful when checking the radiator. There have been reports of some mechanics being painfully burned by escaping steam when removing radiator caps.

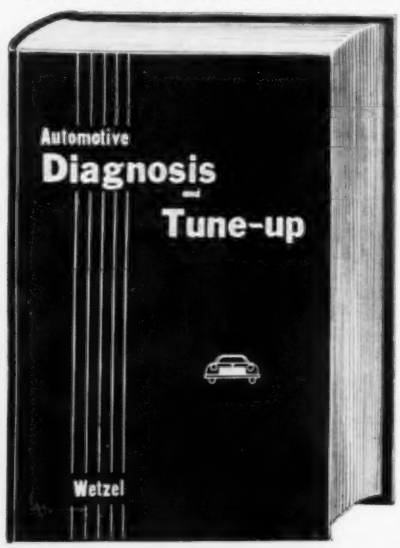
Coolant levels are not always checked when cars are delivered. The low level in a pressure system may not be sufficient to cause overheating, but may create enough steam to give you trouble when you open the cap—so be careful!

FOR LIVE WIRES ONLY

THE MASTERFUL SECOND EDITION OF THIS POPULAR BOOK IS NOW READY

The new chapters on The Automotive Oscilloscope and Tune-Up Procedure alone are worth the price of the book! It is a "Gold Mine" of information.

MAKE THIS HELPFUL INVESTMENT TODAY!



- Price $6.45 Postpaid
- 550 pages Size 6"x9"
- 600 Illustrations
- Approved by Chicago Board of Education
- Approved by Sun Technical Training Centers
- Money refunded if not satisfied in 10 days
- Send for free descriptive folder

MASTER TECHNICAL PRESS

1010 W. Crescent Ave. PARK RIDGE 3, ILL.

Better Gas Mileage Can Only Come Through Joint Owner-Service Effort

• MORE GAS MILEAGE *can* be obtained for modern automobiles if owners and service men will work together, according to Howard Gladding, service manager for GM's Rochester Products Division.

Mr. Gladding suggests that mileage complaints can have happy endings only if:

1. Inspection and adjustment of the car include all systems and components that can affect fuel economy.
2. The motorist's driving habits are taken into consideration.

TEAMWORK IS ESSENTIAL

Since either mechanical adjustments or driving habits can be responsible for low mileage, teamwork between owners and shop men is essential to a satisfactory solution. And, many owners have their own mileage standards . . . a "feeling" they should get some specific number of miles per gallon, often without regard to the number of power accessories they enjoy. An explanation, by the service man, of the fact that these accessories require energy to operate, and that this energy must come from the car's gasoline supply, often is helpful.

Such driving habits as excessive speeds, "jack-rabbit" starts, prolonged idling, excessive use of the passing gear and inconsistent acceleration cannot be expected to contribute to economical motoring, Mr. Gladding states.

CARBURETOR ONLY THE START

Another owner habit that may well be an obstacle in the path of better handling of mileage complaints is known to mechanics as "pre-diagnosis." For example, almost every service man has been confronted by a customer whose car is not yielding top gas mileage, who says his carburetor is at fault, and who demands satisfaction.

To customers like this, another explanation is in order, says Mr. Gladding. While complaints of this nature are sometimes justified, it should be pointed out that the carburetor is only one link in the long chain of engine operation, and that its efficiency is dependent on a variety of factors such as proper spark and valve timing, engine compression, ignition and many others.

To help service men get to the heart of the fuel economy complaint, Mr. Gladding urges that every mileage diagnosis begin with an interview with the motorist to assemble all facts.

The justification of the complaint then can be determined by mounting a reliable gas-per-mile gauge on the car. The owner should then be asked to drive the car at a steady, constant speed over a level road, and the fuel consumption in both directions checked to compensate for wind and other variables over the test run. The computed average will prove whether or not the complaint is justified.

If the baseline check shows excessive fuel usage, a complete engine tune-up should be made.

The practice of installing a leaner main metering jet to improve fuel economy should be discontinued, Mr. Gladding points out. If the difficulty lies elsewhere, and it usually does, the leaner jet may cut down performance without improving economy. Only in extreme altitudes should this step be considered.

GAS CONSUMING SYMPTOMS

There are many factors—other than carburetion—in a modern automobile's

(Continued on following page)

Calendar of Automotive Events

1958

August 27-30—Automotive Parts Rebuilders Assn., National Convention and Trade Show, Conrad Hilton Hotel, Chicago, Ill.

Sept. 15-20—Automotive Electric Assn., Fall Meeting, Broadmoore Hotel, Colorado Springs, Colo.

Oct. 15-18—National Glass Dealers Assn., 1958 Convention, Americana Hotel, Miami Beach, Fla.

Nov. 3-6—Automotive Warehouse Distributors Assn., Inc., National Convention, Muehlebach Hotel, Kansas City, Mo.

1959

Jan. 17-25—Chicago Automobile Show, International Amphitheatre, Chicago, Ill.

Jan. 31-Feb. 4—National Automobile Dealers Assn. Convention and Equipment Exhibition, Conrad-Hilton Hotel, Chicago, Ill.

Feb. 15-17—Motor and Equipment Wholesalers Assn., National Convention, Conrad Hilton Hotel, Chicago, Ill.

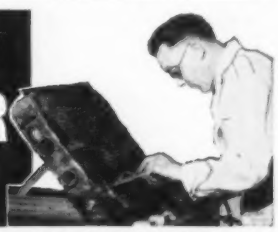
Feb. 15-17—Automotive Affiliated Representatives Meetings, Pick-Congress Hotel, Chicago, Ill.

Feb. 18-21—Automotive Service Industries Show, Navy Pier, Chicago, Ill.

March 12-15—Pacific Automotive Show, New Brooks Hall, San Francisco Civic Auditorium, San Francisco, Calif.

May 3-8—Top Management Institute, Motor and Equipment Wholesalers Assn., Allerton House, University of Illinois, Monticello, Ill.

Why Send RADIATOR Jobs Away?



Many Adding $8,000-$12,000-$15,000 a Year Servicing Radiators!

"Our Inland radiator dept. is taking in an average of $300 a week!"—Douthit-Carroll-San Chez Co., Memphis, Tenn. "Grossed $18,000 the first 9 months."—Harvey C. Jones Co., Reseda, Calif. "Made over $500 my first month."—Roberts Service, Blacksburg, Va. "Taking in $50 a day."—Tillie's Service, Fargo, North Dakota.

Motor Service survey shows radiator repair jobs were up 15.8% last year. Profits from radiator work are sure to steadily become even better due to increasing cooling system pressures.

FREE 48-pg. book, all about Inland equipment, easy-pay plan, free factory training school.

INLAND MFG. COMPANY,
1108 Jackson St., Dept. AD-8, Omaha 2, Nebr.
World's Largest Manufacturer of Radiator Servicing Equipment

WRITE INLAND MFG. CO., Dept. AD-8, 1108 Jackson St., Omaha 2, Nebr.
Please send new free book, "Blue Print For Profits."

FIRM _____
PLEASE PRINT
ADDRESS _____
CITY _____ ZONE ___ STATE _____
BY _____ TITLE _____
If dealer, make of car sold _____
Are you now operating a radiator dept.? ☐ Yes ☐ No

Gas Mileage . . . CONTINUED

performance that can contribute to poor gas mileage. According to Mr. Gladding, a malfunctioning ignition system is among the most notorious offenders. The condition and setting of the spark plugs, distributor points and most important, spark timing, particularly on a high compression engine, seriously affect fuel economy, he added.

Other common gas consuming symptoms, and their diagnosis, listed by him are:

- Low or uneven compression. *Diagnosis*—compression test by pressure gauge.
- Ignition timing slow. *Diagnosis*—check with timing light and with vacuum advance line plugged.
- Spark plugs. *Diagnosis*—bad plugs will cause engine miss at low speed on hard pull or engine will cut out at high speed.
- Automatic transmission linkage, slippage or shift points not set at correct engine rpm. *Diagnosis*—check for slippage and check shift points with tachometer.
- Manifold heat. *Diagnosis* — check heat control valve for free operation . . . possibly heat passage plugged with carbon. To check, start engine cold and feel legs of intake manifold for first few minutes while engine is running. Center leg should be warmer than others.
- Tire pressure . . . tires five pounds too soft can cost an extra mile every gallon of gas. *Diagnosis*—check tires periodically.
- Oil-bath air cleaner . . . restriction from improper weight oil, too much oil, or dirt. *Diagnosis*—be sure to clean regularly, refilling to proper level with oil of weight recommended by the manufacturer.
- Vacuum advance unit. *Diagnosis*—connect timing light and check advance with and without the vacuum advance lines connected with engine running at 2,000 rpm. If there is no difference in timing with or without the vacuum advance line connected, vacuum advance is defective.
- Fuel leaks. *Diagnosis*—check for leaks at tank, along lines, pump and carburetor.
- Cooling system. *Diagnosis*—check for proper operating temperature. If not within limits, examine thermostat, hose, water pump, pressure cap, fan, shroud (if used), antifreeze and leaks.
- Burned points.
- Bad condenser or cracked distributor cap.
- Defective high tension cables leading to spark plugs.
- Sticking valves.
- Incorrect brake adjustment—causes drag.
- Obstruction in exhaust system (muffler).

MAKE A THOROUGH INSPECTION

When these factors are eliminated as sources of fuel loss, then and only then should carburetor adjustments be made, Mr. Gladding states. He recommended that carburetor inspection include the idle vent adjustment, pump boot, idle adjustment, float adjustment, automatic choke adjustment, throttle body heat passage, power piston, power valve, metering jets, needle and seat, power piston vacuum passage, and choke piston. All filters should be checked, too, he added, since foreign materials introduced into the system make efficient operation impossible.

The terrain, whether hilly or flat, also has its effect on gas consumption —added power is needed for hill climbing, while congested city traffic conditions require frequent starts and stops along with extended idling periods.

With these practices adopted by the service man and with the full cooperation of the motorist, everybody will benefit, Mr. Gladding emphasized.

BULLETIN

Mr. Mechanic:
The owners of the following cars are having trouble with vapor lock, gasoline fumes and poor general performance during hot weather driving:
Ford - Mercury-Lincoln-Chevrolet - Oldsmobile-Chrysler
Here is the trouble maker:

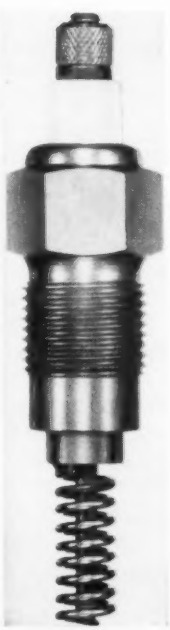
The trouble fools many mechanics because it only occurs when the engine is a little overheated, such as -- in heavy traffic (Stop & Go), pulling a long hill, starting after brief stops (you know how the engine heat will raise when you first stop and the car is hard to start again immediately). Bear in mind, all these cars have nearly the exact same heat tube in the exhaust manifold to feed hot air to the automatic choke. The air passing through this original heat tube gets super hot and heats up the choke housing and adjacent carburetor body with extreme temperature, causing gasoline to boil, creating vapor lock and producing gasoline fumes. The BPS Choke Stove being mounted on the outside of manifold does not deliver this terrific hot air making for the above conditions, but it will supply just the right amount of air at correct temperature. The Choke Stove is guaranteed to perform to satisfaction or your money refunded.

SEE YOUR JOBBER

BRAKE PARTS SPECIALTY

1914 West Washington Blvd. **Los Angeles 18, California**

Here's One Plug That Never Needs Gapping



Yes, there are plugs that never need gapping . . . they are the glow plugs installed in the intake manifold of Diesel engines to aid cold starting.

They operate on 6 volts, and use a resistor on 12-volt systems in order to avoid burning out the glow element. When the operator gets the engine started, he turns off the glow plug and it is no longer used until the next cold start.

The plug shown here is a Champion AG-2 used in Cummins Diesel engines.

BRUSHING UP ON THOSE

EASY-TO-FORGET THINGS

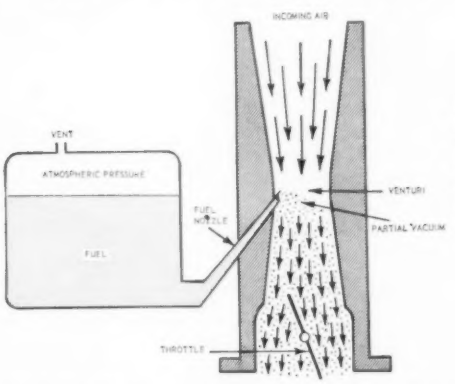
Refresher course

Air-fuel flow in the carburetor

● A TAPERED RESTRICTION in a pipe or tube is called a venturi. The effect of the venturi, in a carburetor, for example, is the creation of a partial vacuum in the air stream just below the restriction.

The partial vacuum exists in the venturi at a point where the tip of the open end of the fuel nozzle projects through the carburetor body casting.

The fuel nozzle extends from the carburetor float bowl, or fuel reservoir, which is vented to the atmosphere. When air flows through the carburetor



Simplified diagram showing how atmospheric pressure forces fuel through the fuel nozzle into the air stream at the restriction (venture) below which a partial vacuum exists.

air horn the vacuum is produced below the venturi and as the throttle is opened wider the increased speed of the air through the venturi creates a greater vacuum.

The air, made up of separate particles or molecules, coming in through the air horn does so at fairly constant speed. But, obviously as the air gets to the venturi, which is smaller in diameter or restricted, the air has to speed up so all the air particles can get through. In so doing the particles become more separated (air-thinned out) and thus a partial vacuum is created just below the restriction. Thereupon, the pressure of the atmosphere forces the fuel from the fuel reservoir, into the nozzle and out into the air stream, where the air and fuel are mixed before entering the intake manifold as a combustible mixture.

Promote Your LEADER Cars with Revolving Multi-Color FLASHES

TRIPPE LEADER LIGHT

Mount on hood or roof of car by its suction cup base or hang from post!

60 COLOR CHANGES EVERY MINUTE

They won't pass you by if you catch their eye with this fascinating attention getter!

Nothing like it! No installation necessary. Ready to operate the minute you plug it in. Use indoors and outside . . . completely weather-proof! Can increase traffic 25% the first day. Simply press suction cup on car roof—or mount in showroom window or in car lot.

Don't Delay! Get the Facts!

TRIPPE MFG. CO.

Dept. E-5—133 N. Jefferson St., Chicago 6

You'll do better with Shurhit

WC 142

This is an excellent Wall Cabinet assortment for service stations, super service stations and small garages. It provides adequate initial coverage of the fastest moving items — Assembled Contact Sets, Condensers, Caps, Rotors, Coils and related parts. Full length door permits locking cabinet which is 22" wide, 27" high and 11" deep. For full details on this and other assortments, see your Shurhit Jobber or write us for Catalog No. SS.

Shurhit Quality IGNITION

Shurhit PRODUCTS, INC.

Waukegan, Illinois

WORLD'S FINEST IGNITION

Fuel Control . . . *(Continued from page 55)*

Manifolding is a complex problem. For the engineer, it involves intricate casting problems, as well as the flow characteristics of vapor and gases. Manifolds are designed to conduct the fuel-air mixture to the cylinders in a balanced, equally proportioned supply, and to lead the exhaust gases out the tailpipe unrestricted.

Exhaust manifolds also are designed to provide a method of automatically preheating the fuel-air mixture in a section of the intake manifold to assure satisfactory fuel atomization under cold operating and idle conditions. This is the function of the manifold heat valve assembly. The valve works much like the damper in an old fashioned coal stove. When the engine is first started, the valve is closed. The closed valve directs the hot exhaust gases around a section of the intake manifold which is immediately under the carburetor. The heat which is exchanged to warm the intake manifold also is transferred to the incoming fuel-air mixture. The warmed mixture holds the particles of gasoline in suspension so that all cylinders receive an adequate supply of fuel.

A very important factor in fuel control is assurance of clean air entering the engine. The lastest dry-type filter elements, which come in many shapes and sizes, are easily serviced.

As the engine warms up, the valve is automatically opened to allow the hot exhaust gases to flow directly out the exhaust system without being routed around the intake manifold.

Because of an off-center mounting of the valve plate, and a heavy counterweight, the valve plate is also closed when the engine is idling. This feature is desirable to prevent carburetor icing, which can exist even when the atmospheric temperature is well above 32°F.

A non-operating manifold heat control valve can be the source of a number of serious engine complaints from poor mileage to burned valves. It's important, therefore, to make sure the valve is operating properly at all times.

Generally, all the maintenance the valve assembly requires is a treatment of penetrating oil at frequent intervals to prevent the valve shaft from seizing in its bore in the manifold because of excessive lead oxides being deposited on the shaft bearing surfaces. The valve's location—directly in the flow of the hot exhaust gases—dictates that a quality penetrating oil be applied every few thousand miles of vehicle operation.

MUFFLERS

Mufflers are a necessary evil of all automotive vehicles. Without a satisfactory muffling system, the roar of a gasoline engine is objectionable, and illegal. Present mufflers are effective enough to reduce the roar of several hundred working horsepower to a quiet whisper.

The main objections to muffling systems is the back pressure they effect to the flow of exhaust gases. Valve design, especially in high compression, short stroke, V-8 engines, allows for several degrees of valve overlap. The ultimate result of this overlap (both intake and exhaust valves open at the same time) is a contamination of the fuel-air mixture with burned exhaust gases. When the piston goes down on the intake stroke, it's possible under certain conditions—primarily deceleration at high intake manifold vacuum—to pull a considerable amount of exhaust gases into the cylinder along with the fresh charge of fuel-air through the still open exhaust valve.

The problem of contaminated fuel-air mixture within the cylinders is further exaggerated by the exhaust system which tends to set up restrictions to the normal flow of exhaust gases out the tail pipe.

Any back pressure on the exhaust will tend to force more burned gases into the cylinder than is normal. Any amount of dilution is undesirable. Excessive amounts are conducive to engine malfunctions. For this reason, manufacturers recommend replacing mufflers at least every 25,000 miles whether they are rusted through or not. Internal carbon deposits clog the muffler to set up serious restrictions to gas flow.

Aside from quieting the roar of the engine's exhaust, the exhaust system provides a means of carrying away the products of combustion—carbon dioxide and water. Water causes damage to the metal parts of the exhaust system in that it leads to rust which in time renders the exhaust pipe, muffler and tail pipe unfit for service. Carbon dioxide, a product of *complete* combustion, is colorless, odorless, and harmless in amounts normally found in the atmosphere. However, because a rich mixture of fuel-air tends to give the gasoline greater response to rapid acceleration and full power, most carburetors are designed to run slightly on the rich side. Under this condition, the product is no longer carbon dioxide, but *carbon monoxide*, a potentially lethal gas.

Exhaust systems, therefore, serve a very important part in the over all efficient and safe operation of the fuel control system.

Having a bird's eye picture of the design, problems, and working relationship of the entire fuel control system firmly in mind, a serviceman is in a position to render quality work on any individual component which may need attention. Also, he'll do a better job because he will see how single units affect the whole system. In following articles of this series, we will discuss the operation, maintence and overhaul of the various working components of the fuel control system.

Pete De Paolo Offers Family Car Unit

● OUT TO UPGRADE the performance of the family car, Indianapolis champion Pete De Paolo is busy these days promoting his new "500" Turbo-Injector. As head of De Paolo Engineering Co., 2630 E. Spring St., Long Beach, Calif., Pete is flashing his famous grin and swinging about the country in a demonstrator car, championing the merits of that unit.

It is scientifically designed to inject conditioner or top cylinder oil directly into the upper cylinder heat zone. There the fluid is converted into a mist, which combines with the air-fuel mixture to provide constant lubrication and conditioning action. Pete points out that his Turbo-Injector is inexpensive to buy, easy to install quickly, and engineered to fit any engine. He reports that improvement is immediate, in terms of better mileage, quieter operation, longer engine life—"500 performance."

Installing Washer in Vacuum Advance Corrects Warm Weather Spark Knock

According to a recent *DeSoto Service Bulletin*, it is possible that spark knock may occur in 1958 DeSoto cars during part throttle acceleration in warm weather. Should the condition continue after preliminary checks indicate that the ignition timing is properly adjusted and the correct type of fuel is being used, the factory recommends the following:

Install a .065 washer (Part No. 691710) in the vacuum advance, which will slightly retard or change the advance curve. Road test the car, and if spark knock still exists, install additional washers. However, the total number of washers in LS-1, LS-2 and LS-3 models must not exceed *three*; in Adventurer models the total number of washers must not exceed *seven*.

Cooling Hot Radiator Too Quickly Can Cause Top Tank to Collapse

Improper cooling of the radiator top tank has caused tank collapse, according to a Studebaker-Packard service bulletin. Cold water should not be run over the top tank in an effort to cool the radiator before removing the cap, according to the bulletin.

If the radiator is cooled too quickly, air cannot enter fast enough to equalize pressures, with the result that the top tank collapses. There is a greater chance of this happening, of course, if the coolant is low and boiling has occurred.

Instrument Corner . . .

(Continued from page 10)

Man's mind, so he told the operator to put the car on the hoist and raise it up. Sure enough, right where the frame bends up at the front to give clearance to the front suspension, the gas tubing from the tank bends under the side member of the frame, and there was a flattened spot in the tubing where a rock or some other object had partially crushed the tube. It could have been a jack put under the frame; but whatever caused it, the flattened spot was there.

A new piece of tube was spliced into the line, and the fuel pump was again tested. This time the pressure was right up to specifications and the delivery was higher than specified.

This car had been taken to at least a half dozen shops to overcome the trouble, but in spite of new carburetor, new coil, new fuel pump, new plugs, etc., the engine was not a bit better and the owner was about ready to sell the car for junk, he was so disgusted. He was lucky that he happened to go to the shop where the operator had sense enough to get help when he couldn't lick the trouble himself. And the operator was fortunate to have such a source of help as the Instrument Man.

●

TAKE THE MYSTERY OUT OF BEARING JOBS

Make More Profit and Build Customer Satisfaction

When newly installed engine bearings rattle, the bearing caps are sagged . . . They need *FEATHERED SHIMS*

Correct this condition with *Feathered Shims* . . . proved *in service* for twelve years by top mechanics.

Fast, simple installation insures a better profit on every bearing job.

Prove it to yourself *at our expense* by sending for a FREE sample package.

When you have seen the results, order *Feathered Shims* from your jobber.

FREE! A sample of Blaisdell Tapered Shims will be sent free of cost or obligation. SIMPLY MAIL THE COUPON.

BLAISDELL MANUFACTURING CO. ASD 8-58

1342 Coronado St., Long Beach, Calif.

Without obligation, send me a free sample of Blaisdell Tapered Shims, ready for installation, and name of nearest jobber.

NAME_____

ADDRESS_____

CITY_____ STATE_____

Opening A Shop . . . *(Continued from page 41)*

are important. Consider having them set in bold type so they act as eye-catchers. Be sure also to run your name, address, and telephone number with each ad.

Newspaper rates for classified ads are very reasonable. Have several good ones made up and keep them running regularly.

Radio advertising is probably not too good a possibility at first, mostly because of the expense involved. But because radio covers such a wide trading area, consider 10-second radio spots eventually, especially if your trading area is big enough.

The yellow pages of the local telephone book are another excellent place in which to advertise. The same rules apply here. Speak your piece honestly and sincerely and advance solid sales arguments.

In using any media, keep accurate records. Find out which ads bring the best results per dollar invested. Then, concentrate on that type.

Advertising, display, promotion, and publicity are all merchandising aids which you must have working for you. Remember though, that in the end all sales depend on your ability as a salesman. Here is the key: Merchandising aids can create interest and traffic, but **you** must make the sale. It is an immense help to be a good merchandiser. It's an absolute necessity to be a good salesman.

Special Care Needed When Installing Willys Manifold and Valve Cover

To prevent customer complaints, care should be exercised when installing the manifold and/or valve cover on Willys 6-226 engines. According to the factory, it is possible to position the manifold and valve cover in such a manner that the manifold overlaps the upper rear corner of the valve cover. When tightened, the manifold could develop a leak or become cracked.

Chassis Parts Sales Plan Initiated by McQuay-Norris

A completely new sales and promotion plan is announced by McQuay-Norris Mfg. Co., covering their entire line of chassis parts. The plan is designed to help the

front end specialist in both his work and his sales problems.

The plan includes a set of three new puller tools for removing and replacing idler arm rubber bushings, plus the following dealer helps: 1. A large 3-color wall chart showing a composite chassis design and location of parts. 2. A copy of the company's new "Handy-Mite" condensed catalog. 3. A copy of the new "Chassis and Steering Principles," written and edited by the McQuay-Norris Service Engineering Department. 4. A certificate of Excellence, suitable for framing. 5. Several chassis job record forms, and 6. A stock and inventory control plan.

Worn Fuel Pump Push Rod Can Result in Poor Engine Performance Complaints

If the owners of 1958 DeSotos come into your shop complaining of poor high speed performance, lack of power in kickdown or apparent fuel pump failure, the factory suggests the fuel pump push rod be inspected as follows:

1. Remove the fuel pump and push rod access plug at the side of engine below fuel pump opening and slide the push rod out.

2. Examine ends of push rod for indications of wear, then measure the overall length. If the push rod measures less than 3.210", or shows definite indications of abnormal wear or peening, install a new fuel pump push rod (Part No. 1737745).

In all cases where the fuel pump push rod has been found to be worn, and is replaced, the engine oil pan should be drained and flushed, the oil filter element replaced and clean engine oil installed before engine is operated.

According to the factory, push rod wear does not effect the fuel pump lobe of the camshaft, so examination or replacement of the camshaft is not required.

To complete your "Tech Know-How" file on Universal Joints—see and save the September article, which "winds up" this comprehensive series.

TRU-TORQUE

Safety Cups with Metal Expanders

SPEAK FOR THEMSELVES

✓ Assure *Perfect Sealing* on wheel cylinders . . .

✓ *Better Performance* because cups, expanders and springs were designed to work together as a team — achieving the ultimate in smooth, positive action . . .

✓ Prove *more economical* because they eliminate costly comebacks often encountered with unsupported cups.

Give TRU-TORQUE Safety Cups a Trial

Order from your local jobber today!

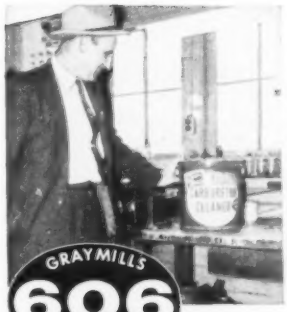
TRU-TORQUE
OTTO-ITEMS, INC.
1200 Reco Ave., St. Louis 22, Mo.

BLITZ
BATTERY CHARGERS
Are Money Makers for Any Shop because they are priced right and fully guaranteed.

A COMPLETE LINE OF CHARGERS
6 and 12 Volts—Fast and Slow
BATTERY WHEELER
BATTERY CHARGING JUMPERS
BATTERY CARRIERS
BATTERY POWER UNITS
TRICKLE CHARGERS
STANDS
WARNING SIGNALS
EMERGENCY STARTING CABLES

Write today for new catalog, prices and details

BLITZ ELECTRIC CO., Inc.
5715 Wentworth Ave., CHICAGO 21, ILL.



"I LIKE 606 BECAUSE . . .

it has no odor and does the best job of cleaning of any cleaner I have ever used. Does not injure hands and is economical to use."

Signed testimonial from Marvin E. Wallace, Service Mgr. and P.A., Anderson Motor Co., Xenia, Ohio.

67

leaves no odor—cleans faster.

GRAYMILLS CORPORATION
3736 N. Lincoln Ave., Chicago 13, Ill.

Advertisers' index

The Advertisers' Index is published as a convenience and not as a part of the advertising contract. Every care is taken to index correctly. No allowance will be made for errors or failure to insert.

AC Spark Plug Division . . . . . 18, 19, 20 and 21
Allied Institute of Technology 49
Ammco Tools, Inc. . . . . *
Armstrong Hydraulics, Inc. . . . . *

Barrett Equipment Co. . . . . *
Blaisdell Manufacturing Co. 77
Blitz Electric Co. 79
Brake Parts Specialty 74
Breeze Corporation . . . . . *
Buick Motors Division . . . . . *

Champion Spark Plug Co. . . . . 2 and 3
Chevrolet Motor Division 7
Chicago Rawhide Mfg. Co. . . . . *
Chrysler Motor Parts Div. (MoPar) 12

Dana Corporation . . . . . *
DePaolo Engineering Co. . . . . *
Ditzler Color Division . . . . . *

Eis Automotive Corp. . . . . *
Electric Auto-Lite Co., The . . . . . *

Frontier Manufacturing Co. . . . . *

General Motors Corporation . . . . . *
Graysmills Corporation 79
Grigg Specialty Tools . . . . . *

Hall-Toledo, Inc. . . . . *
Harvey E. Hanson Co. . . . . *
Houser Engineering & Mfg. Inc. . . . . *

Igniscope, Ltd. . . . . *
Imperial Brass Manufacturing Co. . . . . *
Ingersoll-Rand Company . . . . . *
Inland Manufacturing Co. 73
International Parts Corp. . . . . *

Jack Pack Manufacturing Co. . . . . *

Kal Equip Company . . . . . *
Kedman Company . . . . . *

Lee Company, K. O. . . . . *
Lisle Corporation 57
Lucas Electrical Service . . . . . *

Magnaflux Corp. . . . . *
Maremont Automotive Products, Inc. . . . . *
Master Technical Press 72
Milesmaster, Inc. . . . . *
Milwaukee Electric Tool Corp. . . . . *
Moog Industries, Inc. . . . . 42 and 43

National Automotive Service . . . . . *
National Market Reports, Inc. . . . . 65 and 69

Otto Items, Inc. 78
Owatonna Tool Co. . . . . *

Paser Manufacturing Co. . . . . *
Perfect Circle Corp. . . . . Cover 2
Permatex Company, Inc. 1
Practical Manufacturing Co. . . . . *
Proto Tools . . . . . *

R.S.A. Products Co. . . . . *
Rajah Company . . . . . *
Ramsey Corporation . . . . . Cover 3
Ren Plastics, Inc. 4
Rinck-McIlwaine, Inc. . . . . *

Shurhit Products, Inc. 75
Snap-on Tools Corporation . . . . . Cover 4
Standard Motor Products . . . . . *
Sun Electric Corp. . . . . *

Trippe Manufacturing Co. 75
Tru-Torque 78
Tung-Sol Electric, Inc. 9

United Motors Service 27

Wagner Electric Corp. 11

Firms represented in this issue are indicated by page number. Advertisers in previous issues are indicated by the asterisk.

HE WHO LAUGHS, COME WHAT MAY,

WILL LIVE TO LAUGH ANOTHER DAY

Short circuit smiles

It didn't take very much persuasion on the part of the traveling salesman to get the demure little school teacher to go for a ride in the country with him. They rode and they rode and finally took time out to park. Eventually they resumed their drive and as they did so, the little teacher started sobbing convulsively. Alarmed by her action, the salesman slowed the car to inquire what the trouble was.

"I just can't do it," sobbed the teacher. "I just can't stand up there in front of all those sweet, innocent little children tomorrow after what's happened twice tonight."

"Twice?" questioned the salesman. "What do you mean, twice?"

"Well, aren't we going to stop again on the way home?" she demanded.

★ ★ ★

You're getting old when the gleam in your eye is from the sun hitting your bifocals.

★ ★ ★

A suburban minister was taking a walk when he met one of his parishioners. "Ah, good morning, Mrs. Brown. It is good to see you taking a tramp about the countryside."

"Tramp, indeed!" answered Mrs. Brown. "This is my husband."

★ ★ ★

It was one of mothers most hectic days and when her small son came in with his pants torn, it was the last straw.

"You go right to your room and mend them yourself", she admonished.

Sometime later she went to see how he was getting along. The torn pants were lying on the chair; Junior was nowhere around. Then she noticed that the cellar door, usually closed, was open. She called down loudly, "ARE YOU RUNNING AROUND DOWN THERE WITHOUT YOUR PANTS ON?"

"No, Madam," came the reply, "I'm merely reading the gas meter."

A pastor at the parish always asked the children the same questions, and in the same sequence: "What is your name? How old are you? Did you say your prayers? What will happen if you don't say your prayers?"

An overly ambitious mother rehearsed her little boy with the answers, and when the pastor called, the boy beat him to the punch by rattling off: "Jerry Jones—5—yes—go to hell."

★ ★ ★

A grizzled British colonel, retired after years of service in India, was ill. It was diagnosed as hydropsy. "What's that?" he demanded of his doctor.

"Too much water in the body," the doc explained.

"But I've never taken a drop of water in my life," the colonel snorted. After a moment's reflection, he added, "Must have been that blarsted ice."

"Take it easy the next few hundred miles; call me at once if it has a temperature rise or drop in oil pressure . . . and I want to give it another check-up after 1,000 miles!"

A kindly old gentleman from the East was walking along the main street of a small Wyoming town. As he passed a saloon, the swinging doors flew open wide and a cowboy, whooping and hollering, rushed out, took a running jump and landed in the gutter.

"What's the matter, fella?" asked the old gent. "Did they kick you out or are you just plain crazy?"

"Neither," muttered the cowhand between clenched teeth. "But I sure would like to lay my hands on the so-and-so who moved my horse."

★ ★ ★

He had just completed a long prison sentence and on the great day when those big gates opened and the whole world lay before him, his joy knew no bounds. "I'm free," he shouted, "I'm free!"

A little girl who was playing nearby gazed at him for a few moments and then came over. "That's nothing to shout about," she said, "I'm four!"

★ ★ ★

The origin of the expression, "Hurrah for our side!" goes back to the crowds lining the streets when Lady Godiva made her famous sidesaddle ride through the streets of Coventry.

★ ★ ★

A wealthy New Yorker, in quest of an even wealthier widow, consulted a marriage broker. A candidate described as "a girl who looks like a picture" took the client's fancy, and the broker arranged for them to meet her at a corner table in a certain Broadway night spot.

The client winced as he spotted the woman, conspicuous by her cauliflower ears, a nose that resembled a bent fender, and a hank of hair fell over her forehead like a dangling participle. "I thought," he scolded the go-between, "that you said she looked like a picture."

The broker shrugged, "Either you like Picasso or you don't."

★ ★ ★

Two morons each had a horse, but they could never decide which horse belonged to which moron. They cut off the mane of one horse, but it grew back. They cut off the tail of the other, but it too grew back. Then they measured both horses and found that the white horse was four inches taller than the black one.

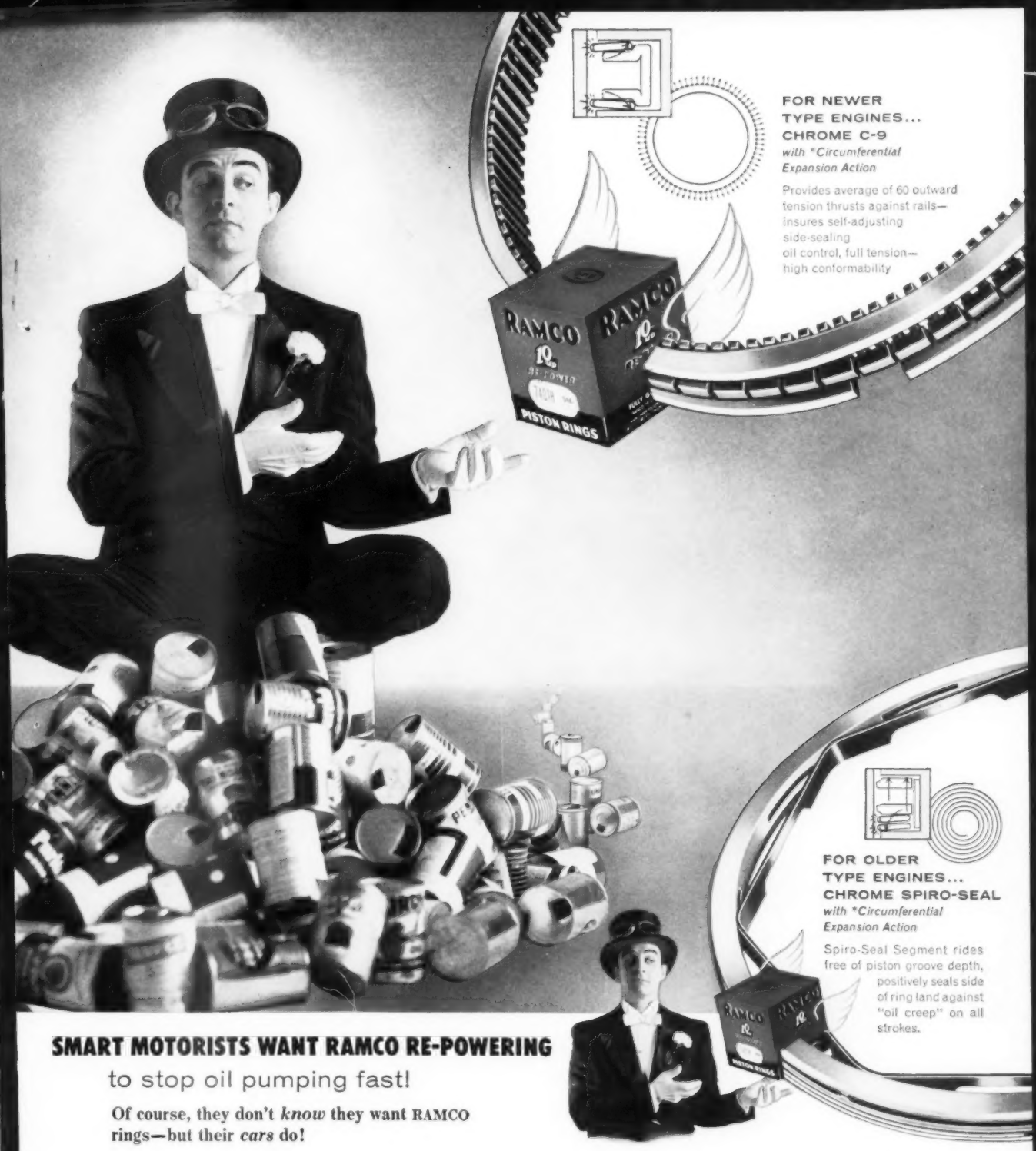
★ ★ ★

A small boy came home from his first day at Sunday School and, while his parents watched amazed, emptied his pockets of pennies, nickels and dimes. When his mother asked him: "Where did you get all that money?" the youngster replied: "At Sunday School; they've got bowls of it there."

★ ★ ★

"Do you know when the saying 'Come across,' originated?"

"Sure—right after the invention of twin beds."



FOR NEWER TYPE ENGINES... CHROME C-9
*with *Circumferential Expansion Action*

Provides average of 60 outward tension thrusts against rails—insures self-adjusting side-sealing oil control, full tension—high conformability

FOR OLDER TYPE ENGINES... CHROME SPIRO-SEAL
*with *Circumferential Expansion Action*

Spiro-Seal Segment rides free of piston groove depth, positively seals side of ring land against "oil creep" on all strokes.

SMART MOTORISTS WANT RAMCO RE-POWERING

to stop oil pumping fast!

Of course, they don't *know* they want RAMCO rings—but their *cars* do!

So do *you!* Smart engine men know there's only ONE ring line that makes them DOUBLE SURE to give customers *immediate* side-sealing oil control—RAMCO 10-Up Piston Ring Sets.

There's a double reason for that—only RAMCO gives you the right *circumferential expansion action** oil ring for *your* particular job—old engine or new. You'll get the Chrome C-9 or the Chrome Spiro-Seal, whichever is best for the engine.

That's why you're DOUBLE SURE with RAMCO!

Be smart! Be DOUBLE SURE of customer satisfaction. See your RAMCO Jobber today.

DOUBLE SURE RAMCO 10 UP SETS

RAMSEY CORPORATION, ST. LOUIS 8, MO., SUBSIDIARY OF THOMPSON PRODUCTS, INC.

Copyright 1958 Ramsey Corporation R-401

A Gold Mine of Tool Information

Snap-on Tools
"THE CHOICE OF BETTER MECHANICS"
FOR PRODUCTION MAINTENANCE AND SERVICE WORK THROUGHOUT ALL INDUSTRY
SNAP-ON TOOLS
Snap-on COMBINATION WRENCHES

Big, new Snap-on® catalog

112 pages packed with information and pictures — over 4,000 quality shop tools, mechanics' tools, work-saving specials.

Your copy of the new *Snap-on* tool catalog is now ready. This big 112-page book brings the complete *Snap-on* line right to your finger tips. Use it to buy from. Use it as a ready reference and guide.

You'll find full details on the wide range of *Snap-on* shop equipment — Anal-O-Scope engine analyzer; tune-up meters, gauges, testers; automatic transmission tools; wheel aligners and balancers; hydraulic service and body-repair jacks; pullers; valve and valve seat grinders. Complete description of *Snap-on* tool chests and cabs. Page after page of high-quality hand tools — wrenches, sockets, pliers, screwdrivers, tool sets — everything the modern shop needs for complete automotive service.

Ask your *Snap-on* man or write us for your free copy of this valuable catalog "W."

SNAP-ON TOOLS
CORPORATION
8018-H 28th Avenue • Kenosha, Wisconsin